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AMERICAN MACHINIST

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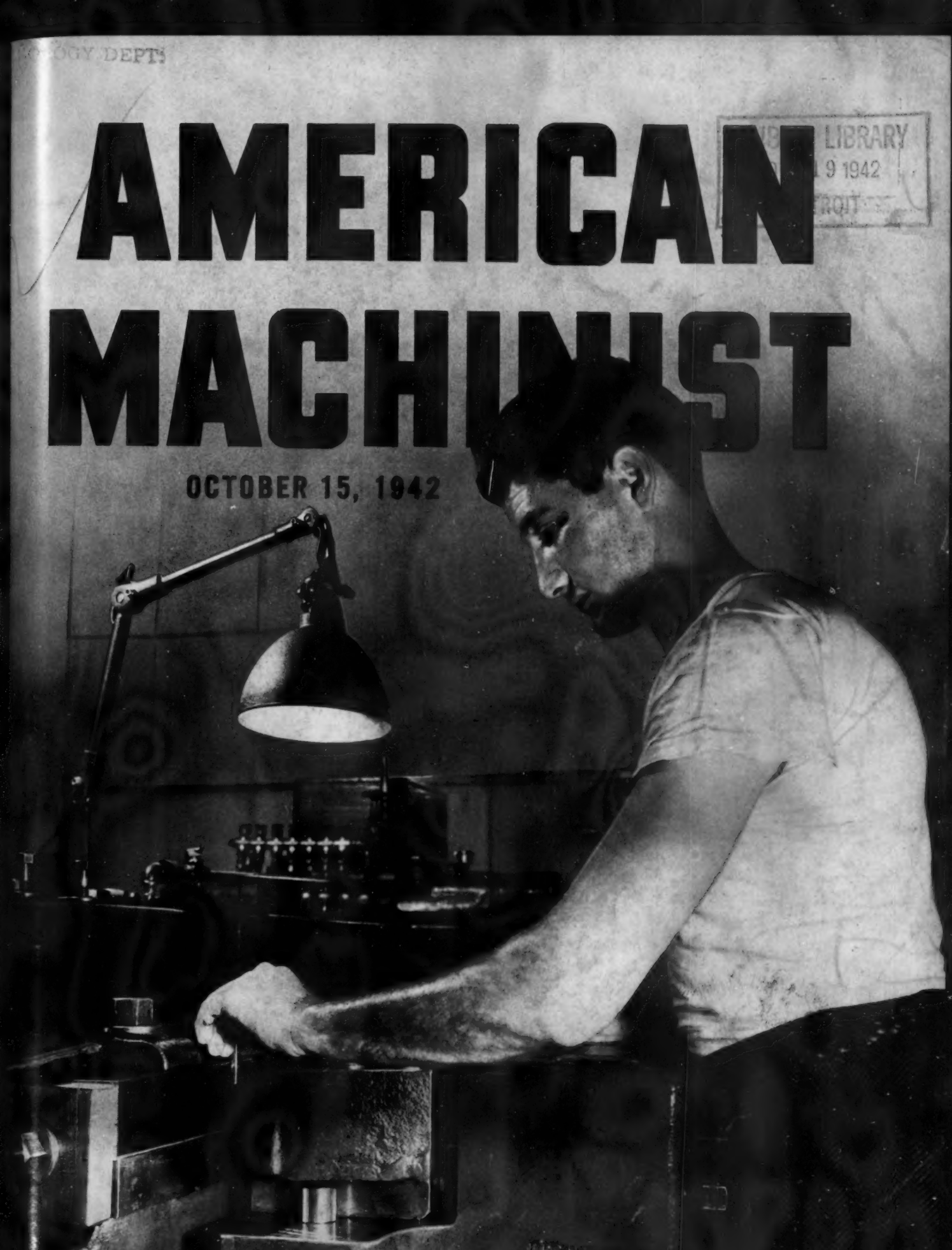
OCTOBER 15, 1942



Close-Tolerance Screw Threads—Page 1151

ARMAMENT: Unleashing the Thunderbolt—Page 1173

A Machine Tool's Best Friend!

54 Heald service men keep 'em producing

3. Maybe you didn't know that your maintenance force has been increased lately. But it has — if you have Heald Precision Boring and Grinding Machines in your shop. When you installed that last Heald machine you added another man to your factory personnel — the Heald Service Man. He's not on your payroll, but just the same he's working for you — helping to keep your Heald producing more and producing longer. He reports for work when your Heald is first installed, setting it up to function at peak efficiency, and instructing your man to operate it that way. After that he'll be on the job periodically giving the machine a careful check-up. In case serious trouble should develop, a telephone call to the nearest Heald branch office will get him back on the job—and the machine, too. He knows that in serving you he's serving America.

Heald 3 POINT SERVICE
Keeps Production Rolling

1. Field Engineering Service
2. Factory Engineering Service
3. Demonstration and Maintenance Service

THE HEALD MACHINE CO. WORCESTER, MASS., U. S. A.

MANUFACTURERS OF PRECISION BORING AND PRECISION GRINDING MACHINES

AMERICAN MACHINIST

October 15, 1942

Thread Rolling—This method can be used for producing screw threads to very close size and finish tolerances

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VOLUME 86 Number 21

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A McGRAW-HILL PUBLICATION

PRINTED IN U. S. A.

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AMERICAN MACHINIST *has been honored by receiving, for the third time in four years, first award in Class I "Best Series of Articles" in Industrial Marketing's Annual Competition for Editorial Achievement*

★ This year, *American Machinist* again entered its every-issue Armament Sections in competition with the cream of industry's editorial services. A total of 49 editors made 67 entries in the Class 1 "Best Series of Articles". And again *American Machinist* topped the field, becoming the first and only 3-time winner of this major editorial award.

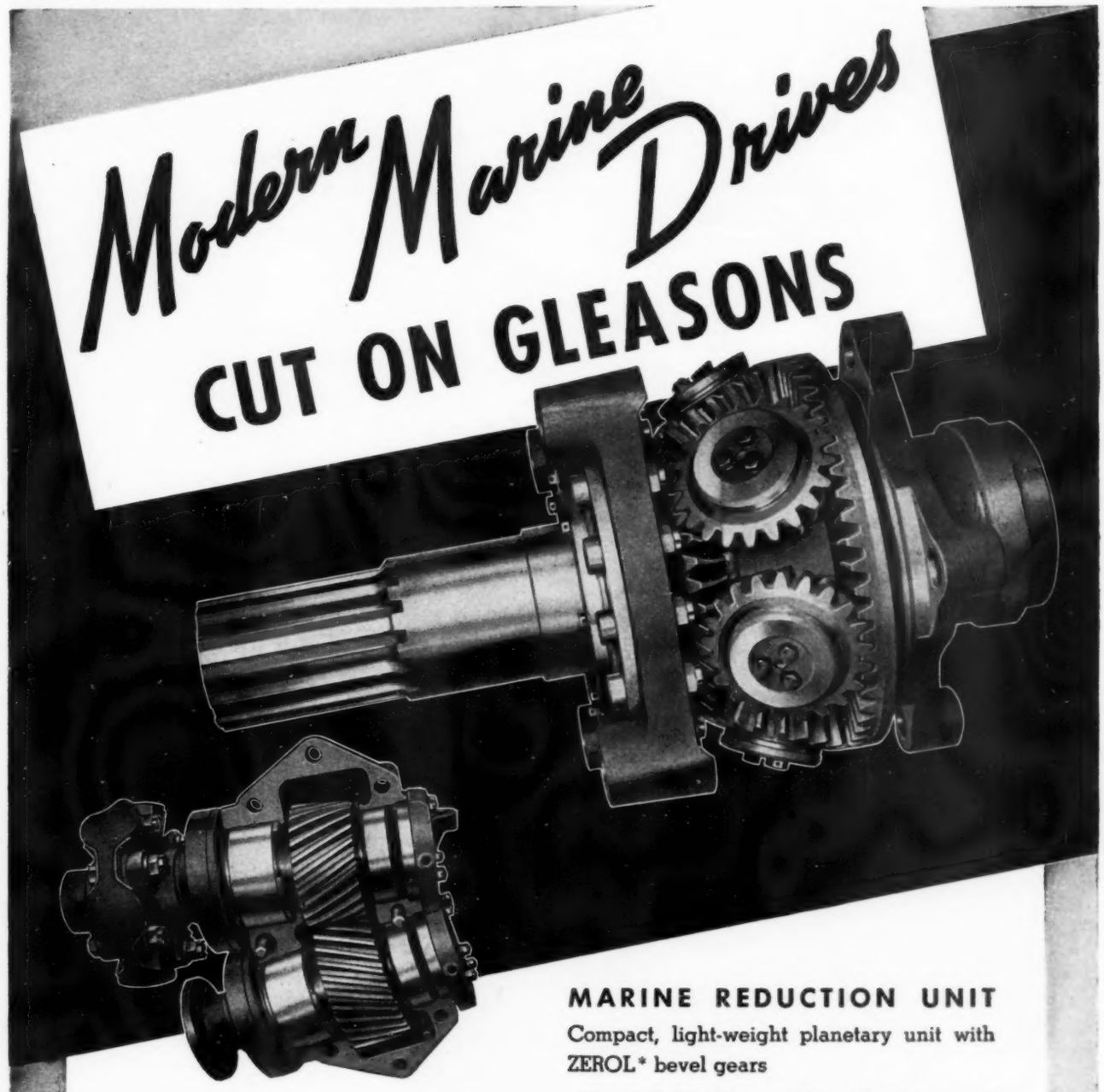
The Editors of *American Machinist* appreciate such recognition of their work. But of far deeper satisfaction is the realization that in helping the men of Metal-Working turn out more tools of war faster, *American Machinist* armament production "know-how" is serving America in her hour of greatest need.

The readers of *American Machinist* can look forward to receiving these fortnightly Armament Sections as long as this need exists.

TOPS IN METAL-WORKING
FOR 65 YEARS

AMERICAN MACHINIST

Modern Marine Drives CUT ON GLEASONS



V BOAT DRIVE

With angular spiral bevel gears, engine is mounted horizontally in stern for best weight distribution

MARINE REDUCTION UNIT

Compact, light-weight planetary unit with ZEROL* bevel gears

*Reg. U. S. Pat. Off.—curved-tooth bevel gears with zero spiral angle and same low thrust loads as straight bevel gears.

For engineering recommendations on bevel and hypoid gears, write Gleason Works

GLEASON

GLEASON WORKS

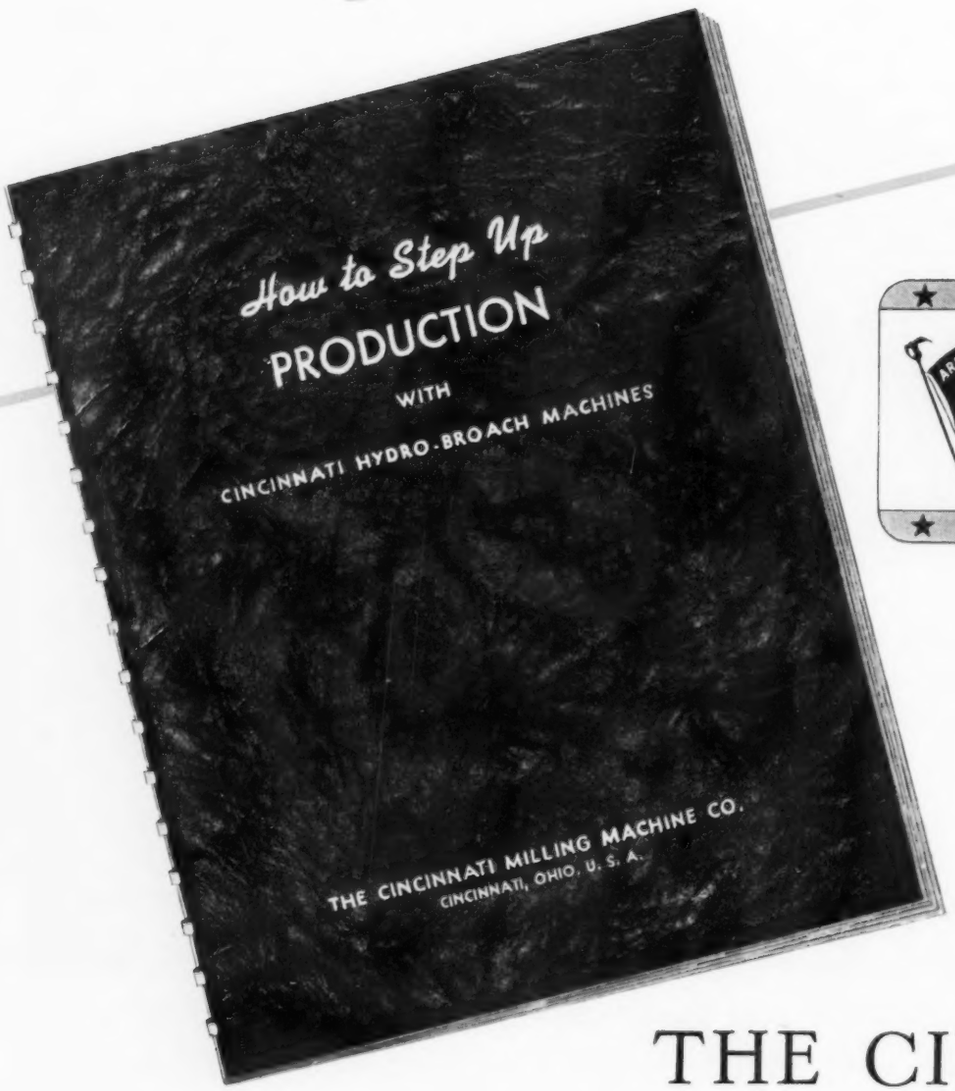
Builders of Bevel Gear Machinery for Over Seventy-five Years

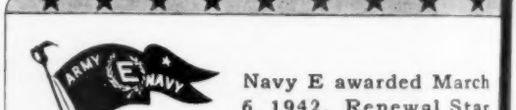
1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

CINCINNATI

Another

ON THE





Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

Illustrated at the extreme righ is a CINCINNATI No. 10-6 Single Ram Vertical Hydro Broach Machine. Specificatio catalog M-886 on request.

THE CINCINNATI MI

TOOL ROOM AND MANUFACTURIN MILLING

guide-post

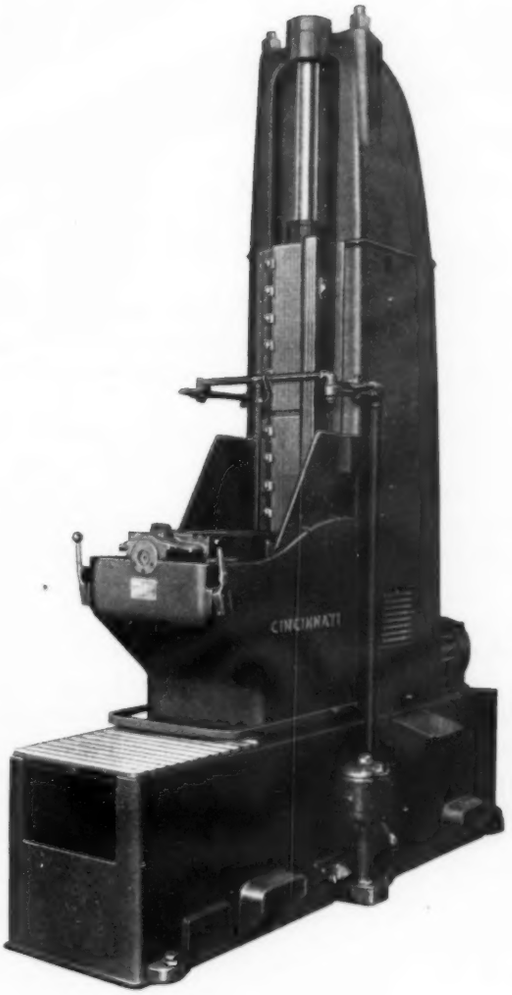
...E PRODUCTION HIGHWAY

THERE are as many answers to the query "how to increase the production of mechanical goods" as there are different kinds of products. Obviously, no one type of equipment covers the entire field of production, but the rate of flow of parts to your assembly line can often be accelerated through the use of an untried or unconventional machining process.

The binder illustrated at the left—"How to Step Up Production with CINCINNATI Hydro-Broach Machines" — is another official communique from broaching headquarters. It contains many actual examples taken from our machine history files.

One example talks about a broach-saw operation and cutters that stay sharp twenty times longer than those previously used. Another example tells of one CINCINNATI Hydro-Broach replacing three other machines, while increasing production six times.

Perhaps the answer to some problem of production in your shop — faster machining processes, fewer consumable cutters, less floor space — will be found in this book. A copy of it will be sent to those interested in more rapid production.



T MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

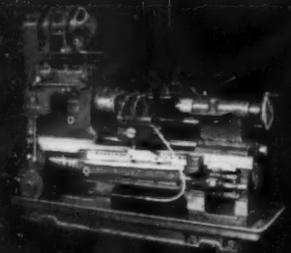
...MILLING MACHINES • SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

THIS country was built by a man with a portmanteau — a traveler, a tall talker, a man with something to say, and with something important to sell.

Probably the most colorful of this country's early traveling men were the machinery and machine tool salesmen. A century or more ago, the journeys of these men were often as protracted as a whaler's voyage, and sometimes more dangerous. For the farthest frontier outpost was the end of their line, and they got there (in order of luxury) by steamboat, schooner, canal boat, stage coach, Conestoga wagon, horseback . . . and even on foot.

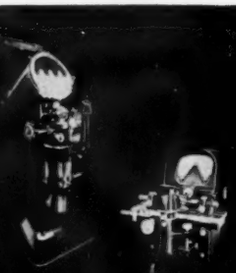
One of these early machine tool salesmen tended bar in a frontier tavern, when he ran out of funds "on the road," while another rode back on a fine white horse — part payment on a new water works for the frontier city of St. Louis!

But they got there, and back — and all of American industry and its products are testament that they had something important to sell!



FAY AUTOMATIC LATHES

AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

ONE on the HOUSE to the Traveling Man!

Today, the men with something to sell are more important to this country than ever before. For America faces a post-war frontier more formidable and more promising than any since the story began.

It is of great importance that business executives realize what the machine tool salesman has to offer.

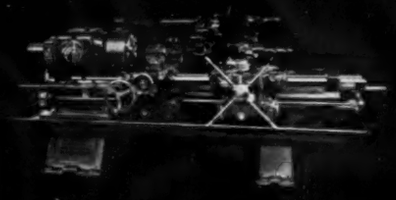
The men who sell Jones & Lamson precision machine tools represent a company offering service that is the product of over a century of continuous machine tool design. That service is available to you *now and every day*, in considering the difficult problems of today, and those that lie ahead.

JONES & LAMSON MACHINE COMPANY

SPRINGFIELD
VERMONT, U.S.A.

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

PROFIT PRODUCING
MACHINE TOOLS

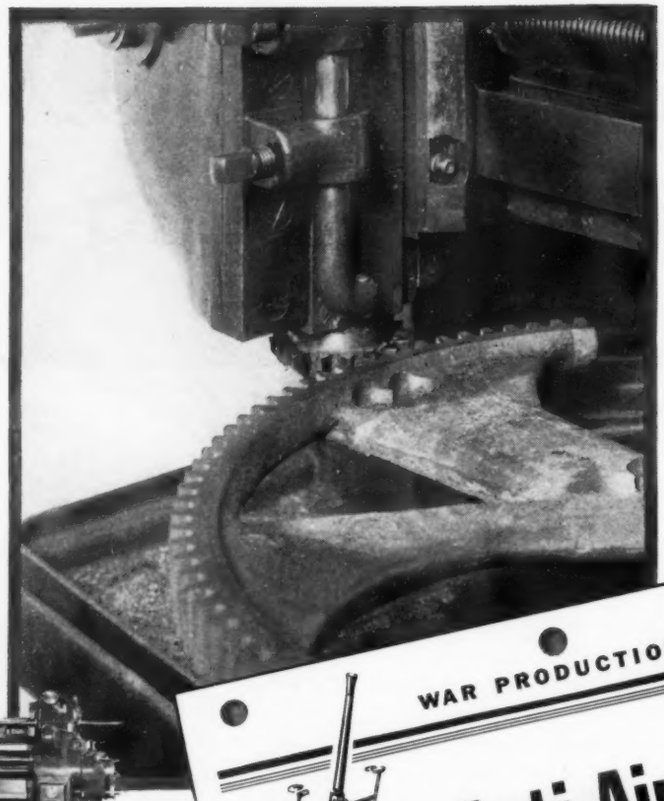


SADDLE TYPE
UNIVERSAL TURRET LATHE

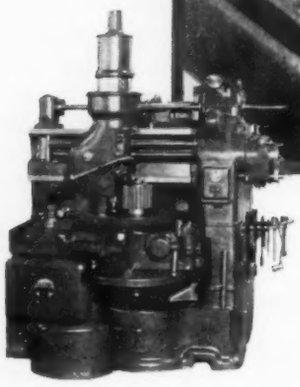
RAM TYPE
UNIVERSAL TURRET LATHE

Gear Tooth To

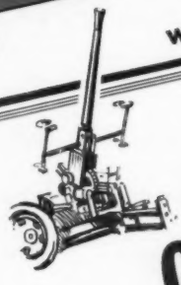
"



Cutting high-precision involute teeth on a segment gear. 6A-type Fellows Gear Shaper used.



WAR PRODUCTION BULLETIN



Anti-Aircraft Gun-Mount Parts

capitalize Gear Shaper precision in the cutting of External Gears, Segments, Elliptical Gears and Racks.

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

Tolerances in

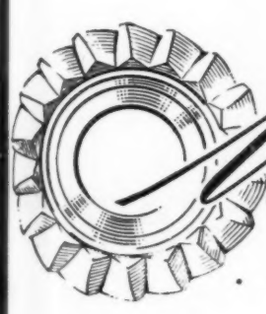
"tenths of a thousandth"

in Sustained High Production

This war is going to be won, in good part, by the superior ability of America's mass-production shop men—their "know how" in the laying out of work, and of inspection routines by which quality standards are maintained.

The versatility of Fellows Gear Shapers permits their use on a great variety of gear-type parts, and on miscellaneous irregular contours as well. The teeth of a whole group of gun mount parts are cut on standard 6A-type Gear Shapers, simply by changing workholding fixtures and cutters.

If a Fellows cutter produces the form you have need for, your problem of high-speed, high-precision production is automatically taken care of. The requisite accuracy can be duplicated indefinitely. For information write the Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bld'g, Detroit, or 640 West Town Office Bld'g, Chicago.



Method

. . . . FROM BLANK TO FINISHED GEAR

Oil them Properly

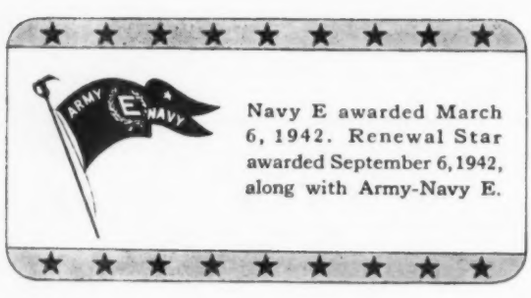
In earlier days, grinding machine lubrication was laborious and uncertain, but relatively simple. It required a lot of work and attention with one kind of oil and a squirt can. Now, automatic features greatly reduce the time and effort of lubrication, but the *right kind of oil must be used,* especially for hydraulically powered machines. This calls for more definite information in the hands of the fellow who handles the oil, and led us to prepare the booklet shown at the right.

It tells where, when and what kind of lubricating and hydraulic oils to apply to all current models of CINCINNATI Machines . . . not only Grinding, but also Milling, Broaching, Lapping, and Cutter Sharpening. To further the interests of continuous production through more intelligent lubrication, this booklet is offered free of charge.

In our files there are hundreds of examples of remarkable life span and continuous operation of CINCINNATI Machines, indicating the proper acceptance of users' responsibility in assuming the lubricating duties. Faithful observance of these lubricating instructions and recommendations will do as much for your machines — help you to maintain continuous production and new-machine standards of accuracy and finish.

CINCINNATI Hydraulic Universal Grinding Machines are available in 12″, 14″, 16″, and 18″ swings; between-center distances up to 72″. Specification catalogs G-486 and G-474 give complete details on all features and their benefits. Copies of these informative catalogs will be sent on request.

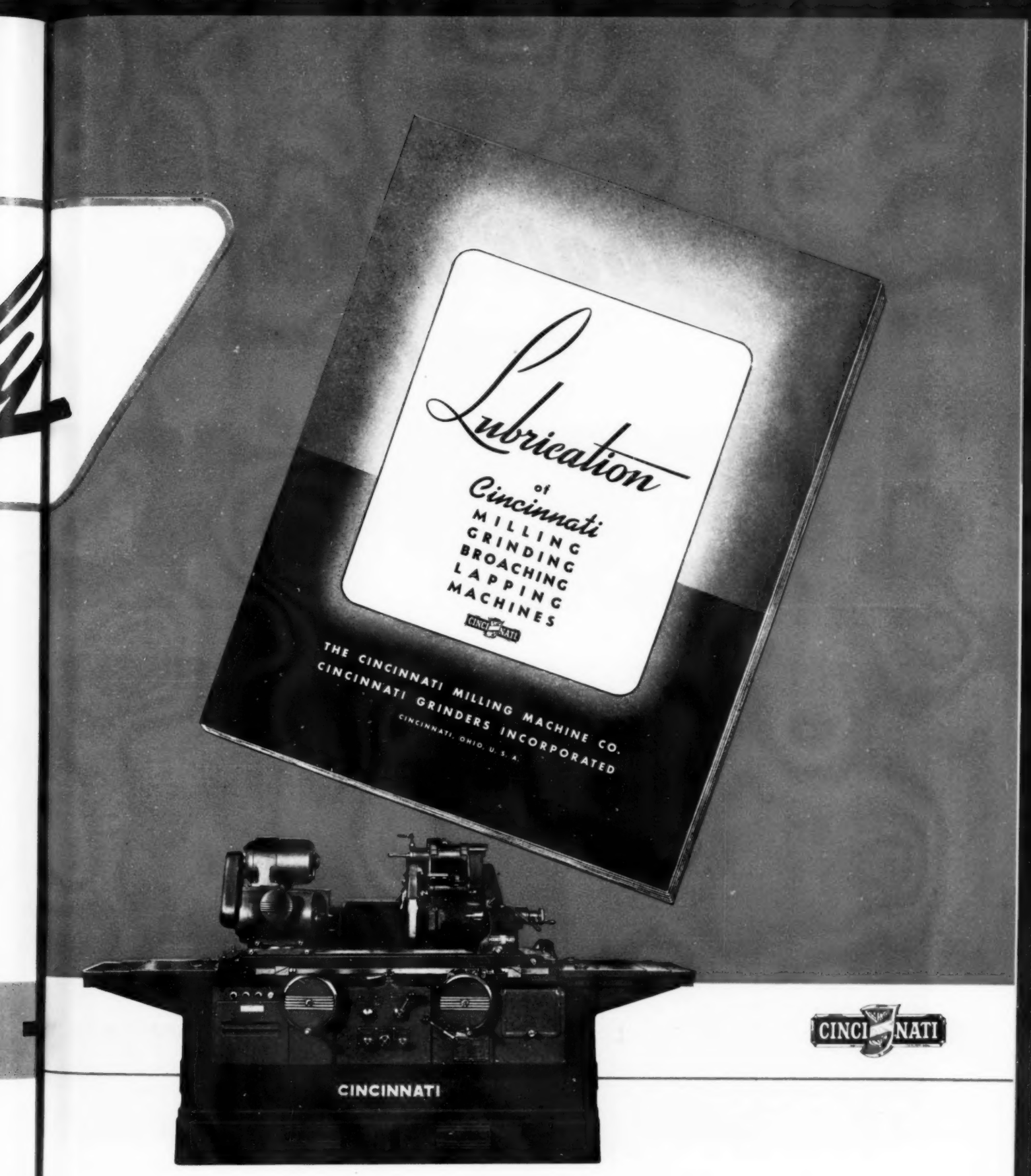
CINCINNATI HYDRAULIC UNIVERSAL GRINDING MACHINE ➡ ➡



Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

CINCINNATI

CENTER TYPE GRINDING MACHINES

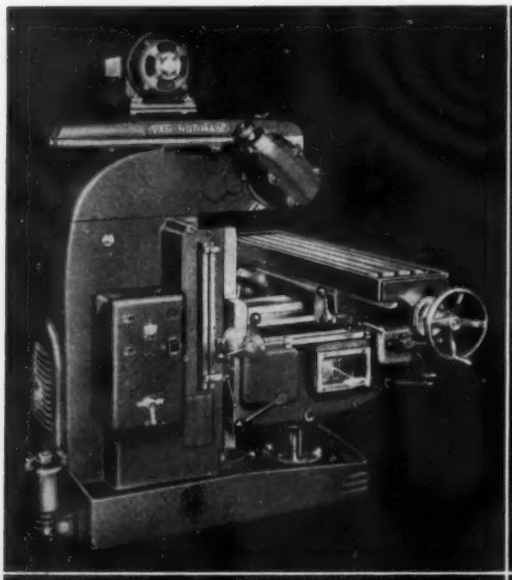


GRINDERS INCORPORATED

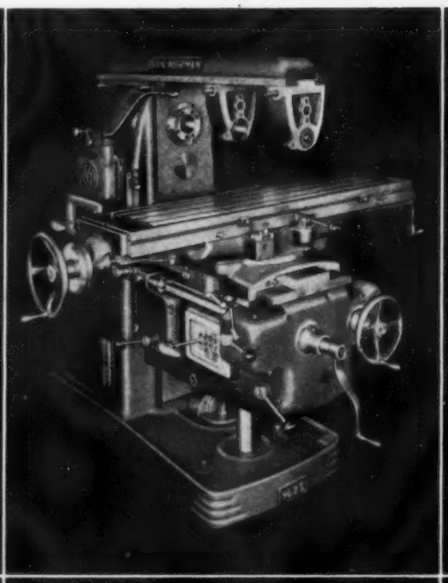
CINCINNATI, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

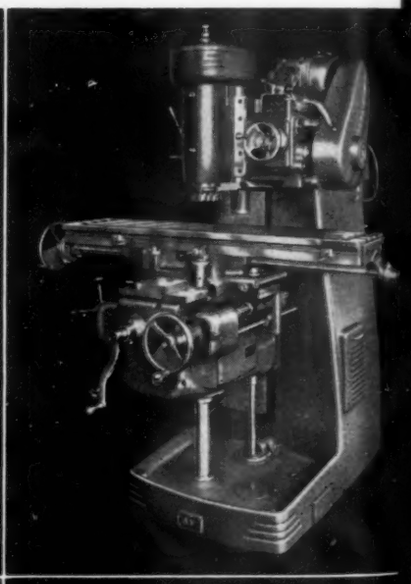
Tools of Peace are now WEAPONS



NO. 26 RAM-TYPE MILLER
Table: 50" x 12"
Range: 28" longitudinal, 12" cross, 18" vertical



NO. 2-5 HORIZONTAL MILLER
Plain and Universal
Table: 50" x 12"



NO. 3-V VERTICAL MILLER
Table: 64" x 14"
Vertical Spindle Adjustment: 5"

OF WAR

NO. 10-C CONTOUR MILLER
Travel of Head: 10"
Maximum Diameter of Work: 18"

THE VAN NORMAN LINE OF MILLING MACHINES needed no redesign for wartime operations . . . and they have required no radical changes since. For more than 50 years of development had given these precision tools the highest adaptability to the most exacting requirements for speed and accuracy that could be imposed *either* in peace or war. Today, Van Norman Vertical, Horizontal, Ram-Type, Contour and Hand Millers are helping to keep vital war work up to . . . and in many cases, *ahead of* . . . schedules in key production plants of all the United Nations. They are making it possible to turn out quality work in unprecedented quantity because of their extreme ease of operation and control, which not only saves time for skilled operators, but also helps new operators to learn their jobs more quickly.

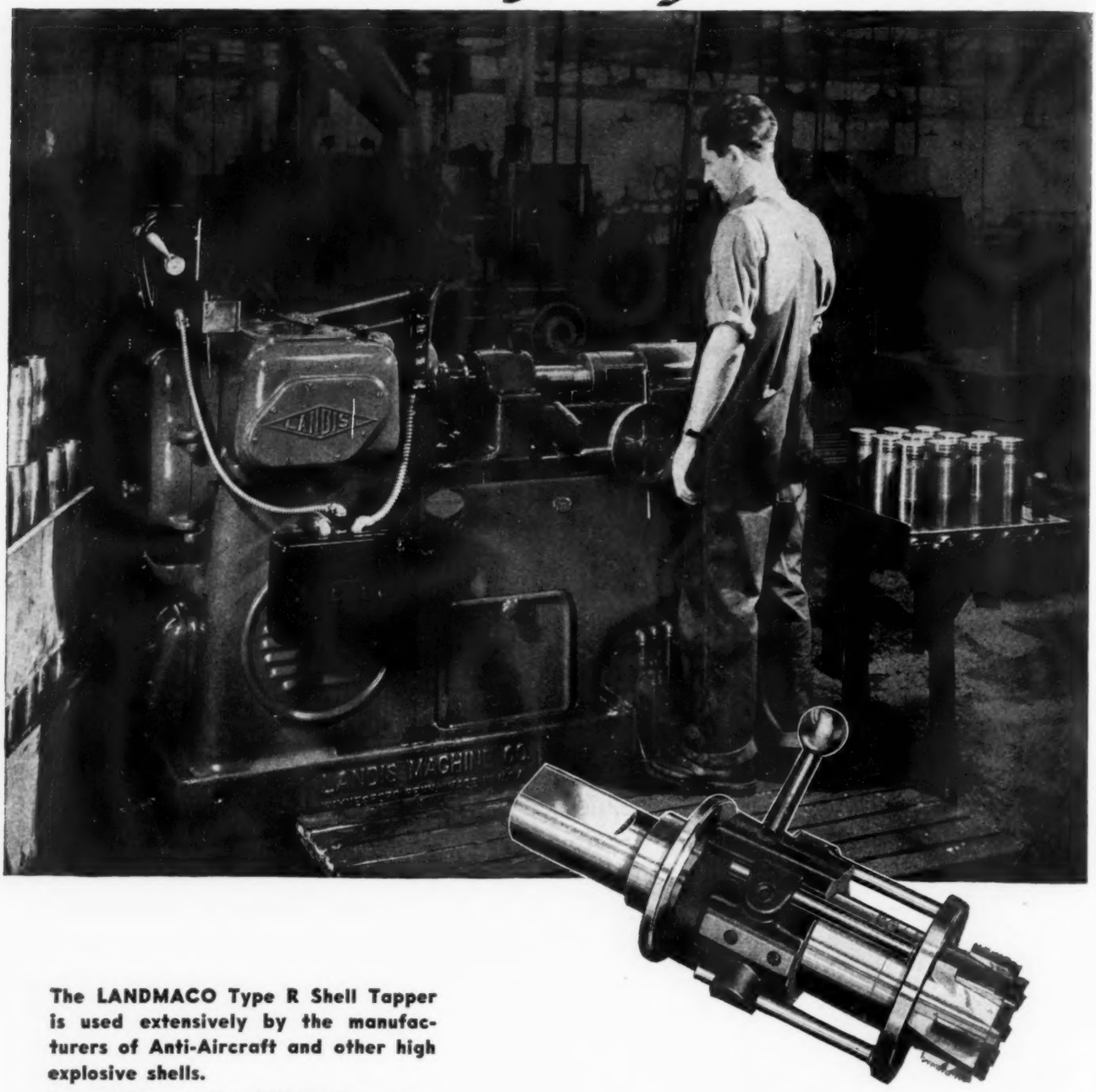
VAN NORMAN MACHINE TOOL CO., SPRINGFIELD, MASS.

Van Norman
MILLING MACHINES

In June, 1942, Van Norman was awarded the Army and Navy E in recognition of its war production record

LANDIS
REG. U.S. TRADE ~ MARK PAT. OFF.

Accuracy + Higher Production



The LANDMACO Type R Shell Tapper is used extensively by the manufacturers of Anti-Aircraft and other high explosive shells.

The ability of the LANDMACO Type R Shell Tapper to produce threads of fine quality, well within the close tolerances required for the unerring performance of the finished product, assures maximum production possibilities for these vital war components.

Write for booklet
"Precision in Munitions Threading"

LANDIS
MACHINE COMPANY
WAYNESBORO, PA., U.S.A.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

LANDIS REG. U.S. TRADE MARK PAT. OFF.

THREAD TIPS

A Good Mechanic Knows and Cares For His Machine

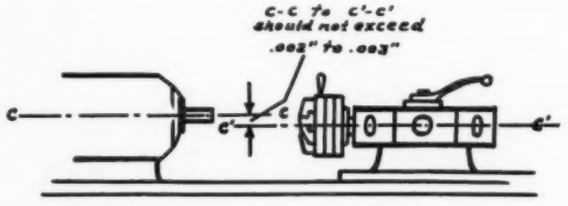
In the Interest of Efficiency, Better Workmanship and Higher Production

THREAD CUTTING COST REDUCED BY CLOSER CHECK ON FREQUENTLY OVERLOOKED DETAILS

Failure to check closely on minor and apparently unimportant details results not only in threads of poor quality finish but also results in short chaser life, low production, and excessive thread cutting cost.

MIS-ALIGNMENT BETWEEN WORK AND DIE HEAD CAUSES CHASER BREAKAGE

The necessity of maintaining alignment within .002" or .003" between the work and the center line of the die head is frequently discounted by many operators, foremen, etc. However, failure to maintain such



alignment will not only cause the chasers to chip frequently in forcing the die head onto the work, but also will result in side shaved threads, lead error, "drunken" lead and taper.

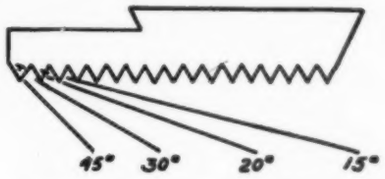
WORK PIECE SLIPPING IN GRIPS CHIPS CUTTING EDGES OF CHASERS

A work piece poorly gripped or "chucked" with result that it slips or rotates in the grips while under cut throws an added load on the chasers that causes minute chipping on cutting edge.

Chasers breaking from work rotating in grips while under cut, usually appear to be soft and worn rather than chipped.

SHORT CHASER THROATS ON TOUGH MATERIALS PRODUCE ROUGH THREADS

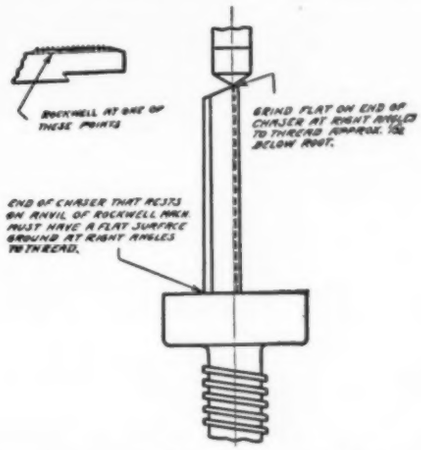
Special consideration should be given to the Chaser Throat employed for various threading operations. The longer the throat, the wider the area over which the cut is distributed. It is obvious that soft materials and free machining steel can be satisfactorily threaded with a comparatively sort chaser throat. Alloy steels, heat-treated materials, etc., that are difficult to machine require a long chaser



throat. In order to assure maximum operating efficiency, longest chaser life, and best quality of thread finish, employ a 15° or a 12° throat where the thread does not approach a shoulder and a few additional imperfect threads are permissible.

CHECKING CHASER HARDNESS BY ROCKWELL METHOD

Many users follow the practice of "Rockwelling" their chasers. To assure that correct hardness readings are obtained we present the


ROCKWELL AT ONE OF THESE POINTS
GRIND FLAT ON END OF CHASER AT RIGHT ANGLES TO THREAD APPROX. 10% BELOW ROOT.
END OF CHASER THAT RESTS ON ANVIL OF ROCKWELL MACH. MUST HAVE A FLAT SURFACE GROUND AT RIGHT ANGLES TO THREAD.

above diagrammatic suggestion for the correct "Rockwelling" of LANDIS CHASERS.

Be Threadwise—Employ LANDIS Long Life Tangential Chasers

LANDIS MACHINE COMPANY
Waynesboro, Penna., U. S. A.

±.0005"? OK Mister, you came to the right place!

GISHOLT

Gisholts are precision built-to produce within close limits of accuracy—and to stay accurate.

GISHOLT MACHINE COMPANY, East Washington St., Madison, Wis.

LOOK AHEAD... KEEP AHEAD... WITH GISHOLT IMPROVEMENTS IN METAL TURNING

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

A
FLEXIBLE NEW TOOL
TO SPEED

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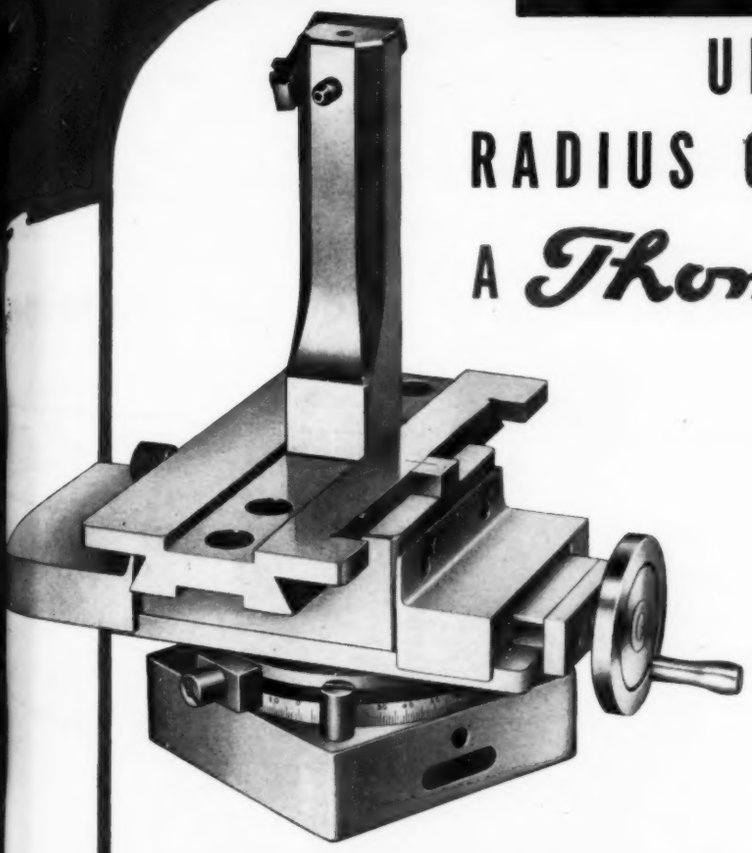
RADIUS GRINDING DRESSER
A *Thompson* · PRODUCT



PATENT PENDING

This Dresser will dress a radius on a wheel either concave or convex from 30 thousandths to 4 inches and do same accurately and efficiently.

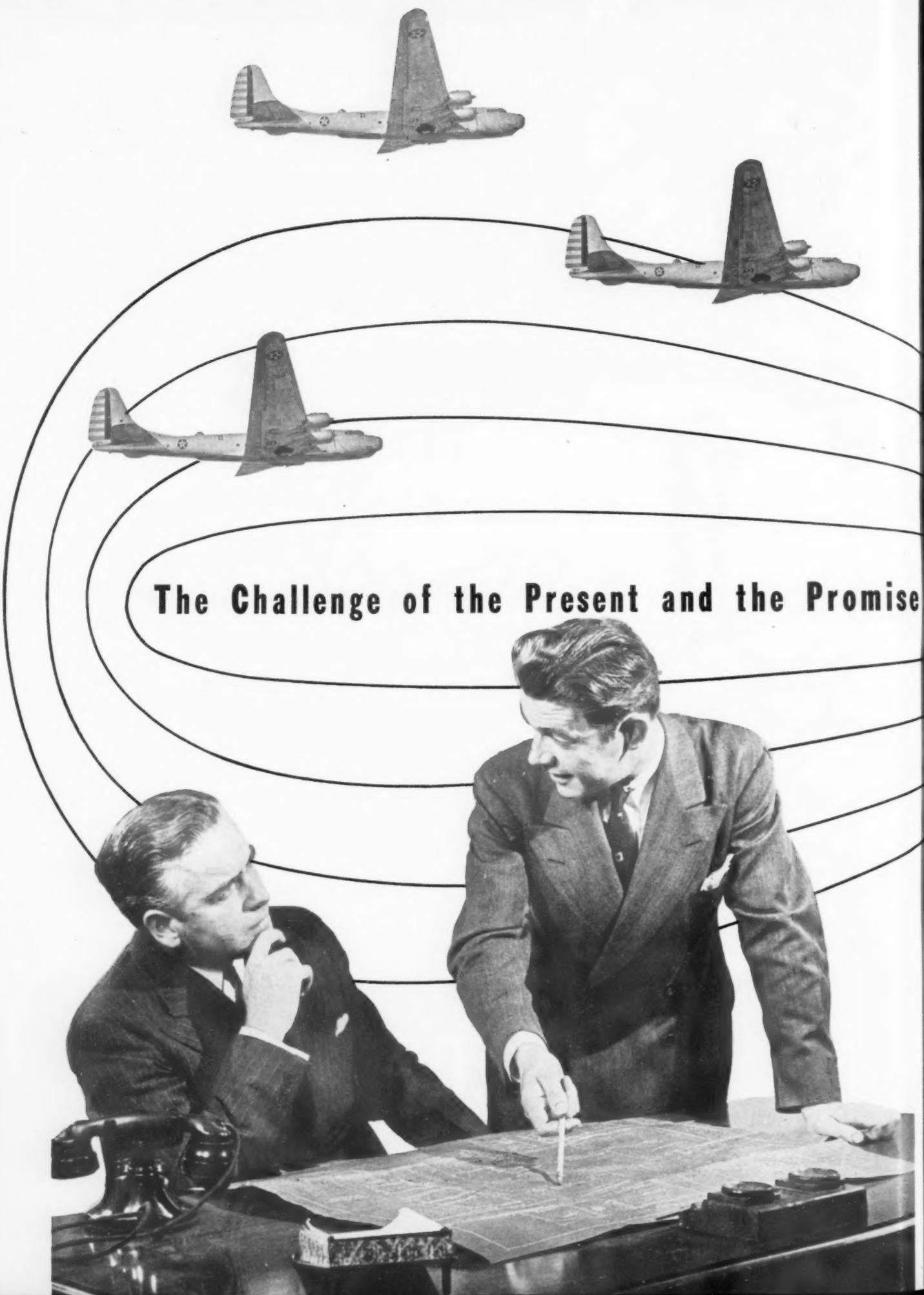
The Dresser is set by gauge blocks eliminating any guess work.

It will also dress any angles required on a wheel.

Also can be set for a radius and angle without changing the set up.

TRADE MARK
Thompson
REG. U.S. PAT. OFF.

AUTO-ORDNANCE *Corporation*


The Challenge of the Present and the Promise of

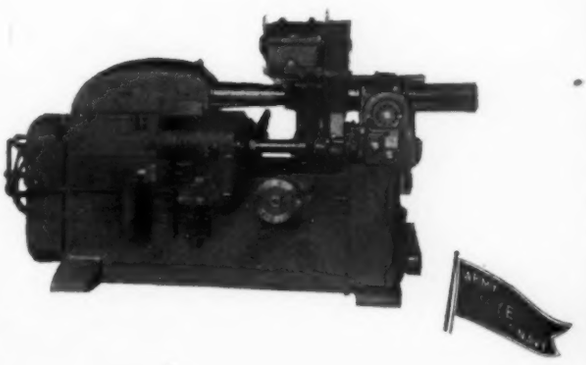
ise of the Future!

THESE are challenging days in which to live and work—and America has met the challenge. Week by week, the people of this country are proving that they can make sacrifices and ignore discomforts. And industry has met the challenge by pooling its knowledge and resources, developing new techniques and materials, and creating a vast new reservoir of supply.

The result of all this is a great new market of the future: A growing demand for millions of war-restricted articles—new, improved products for post-war competition—a backlog of savings created by war bonds and curtailed buying. . . . The result, say many of America's foremost analysts, is *post-war prosperity!*

If you are to be prepared for a quick transition from armament to peacetime business, *now* is the time to study your tooling problems—and in this we can help you. For Bryant engineers are among the foremost authorities in the specialized field of internal grinding . . . and today, with their major war production problems solved, they are once more ready to help you.

Write now and give them full information on your internal grinding problems.

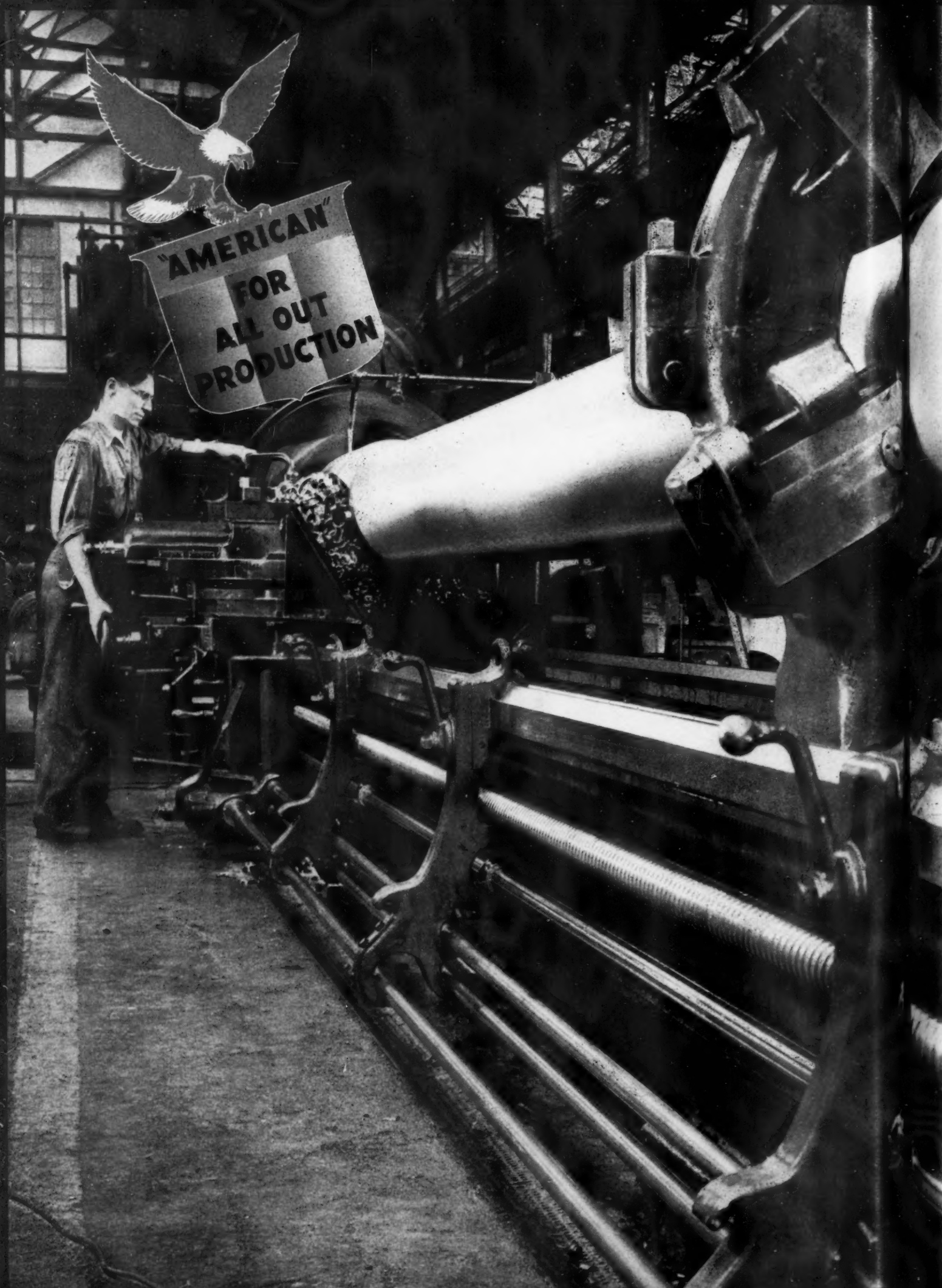


BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

Send for the Man from Bryant


"AMERICAN"
FOR
ALL OUT
PRODUCTION

MIGHTY LATHES *Turn* MIGHTY SHAFTS *for* THE U.S. NAVY

"AMERICAN" 48" Lathes, both in Navy Yards and Contractors' Plants, are adding their enormous power and productive capacity to the building of our "two-ocean" Navy.

"AMERICAN" Lathes, from 14" to 48" sizes, are fast—powerful—accurate. They are meeting the challenge of War demands like all true AMERICANS.

THE AMERICAN TOOL WORKS COMPANY

Lathes - Radials - Shapers

CINCINNATI, OHIO, U. S. A.

ROCK ISLAND ARSENAL EXACTS "ALL OUT PERFORMANCE FROM A NEW MODEL 'A' CLEVELAND *Single Spindle* AUTOMATIC

● Never known to "baby" their old Cleveland Automatics, the Rock Island Arsenal machinists gave this new one "the works" right after it was installed. With some of the finest machinists in this country in this shop, and with a full assortment of America's finest machine tools, a machine has to be soundly built, carefully engineered and thoroughly dependable to stand up to requirements. It may be said that this 1⅜-inch Model A, Cleveland *Single Spindle* Automatic, is "in the Army now."

Here at left are specimens of a typical job assigned to it. Particularly close tolerances are held on the body diameter of this piece. Operations are: feed to gauge, face, turn, chamfer, undercut, form head, thread and cut off. This part is cut from 4140 steel bar stock of 1¼-inch diameter.

In the cautious phraseology of the Foreman Machinist, "Constant performance and accuracy are being held to limits." This Cleveland Model A is working right around the clock, seven days a week, "for the duration."

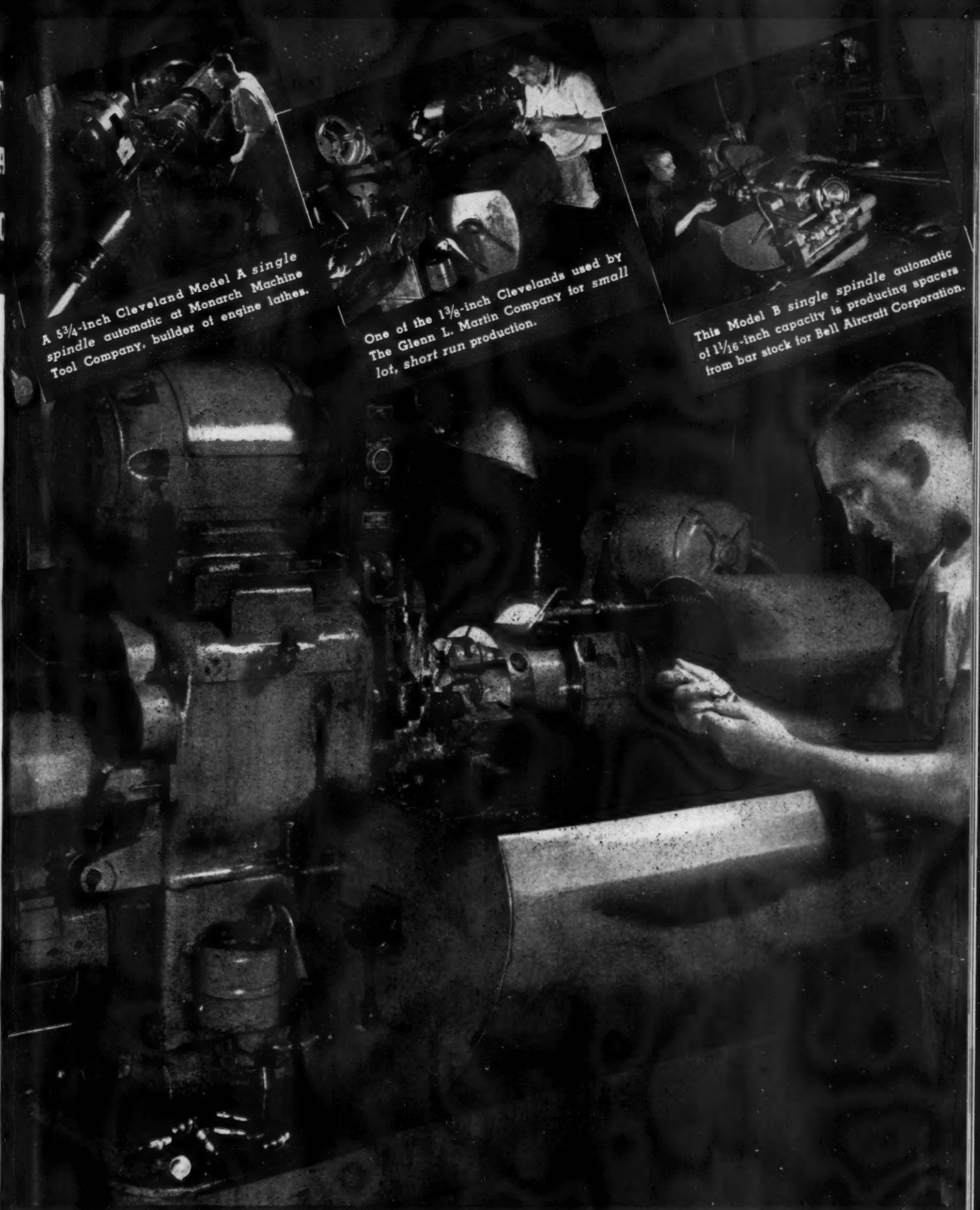
This Cleveland Model A will always be easily tooled up and readily accessible for repairs and maintenance; it was built that way. It was designed to do a job and do it well even under the strenuous conditions of today's production demands. And it really is a hog for work, in any size you use. Tell us what you'd *like it* to do for you, and we will tell you if it can do it *profitably* for you.

THE CLEVELAND AUTOMATIC MACHINE COMPANY
2269 ASHLAND ROAD · CLEVELAND, OHIO

Sales Offices: CHICAGO: 565 W. Washington Street • DETROIT: 540 New Center Building
NEWARK: 702 American Insurance Building • CINCINNATI: 507 American Building

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland *Single Spindle* Automatics if you make duplicate parts in small quantities. By using *single spindle* automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**



A 5 3/4-inch Cleveland Model A *single spindle* automatic at Monarch Machine Tool Company, builder of engine lathes.

One of the 1 3/8-inch Clevelands used by The Glenn L. Martin Company for *small lot, short run* production.

This Model B *single spindle* automatic of 1 1/16-inch capacity is producing spacers from bar stock for Bell Aircraft Corporation.

CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 9/16-inch to 8-inch capacities inclusive

MODEL B—Built in 9/16-inch to 2 1/2-inch capacities inclusive

HURLING DESTRUCTION

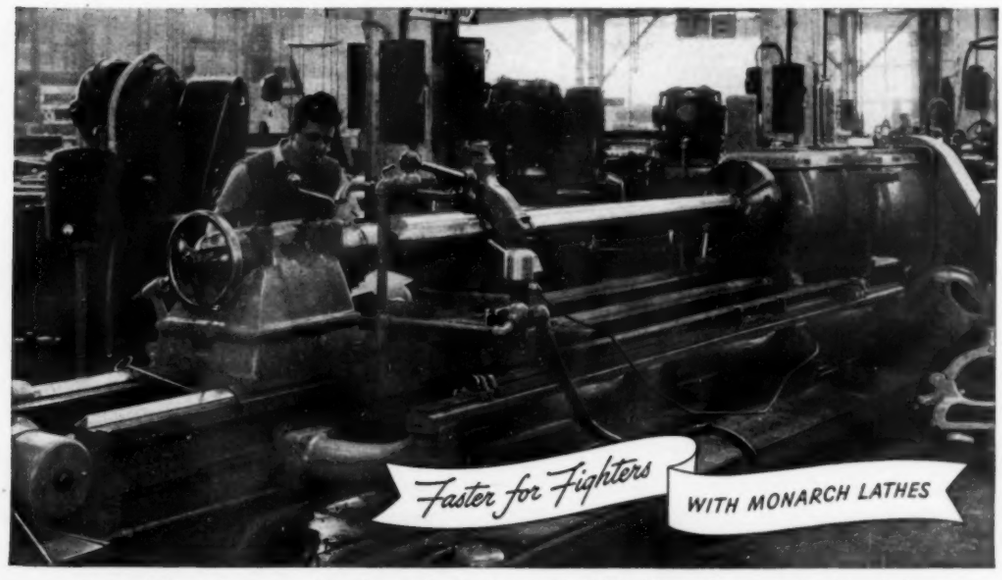
AT THE RAIDERS!

Fighting on every front, on land, on ships, American antiaircraft guns hurl destruction at the enemy—crashing down their planes, smashing their air offensives. From 37 mm to 105 mm, these weapons pour from our production lines with incredible speed.

Part of the ability to produce these guns in such quantities lies in the speed with which barrel forgings are finish machined on Monarch lathes. Monarch's automatic sizing (by which the tool automatically produces the desired contour) is turning out from 2½ to 3 times more barrels per day than by manual control . . . always with the required high standards of accuracy.

Although we're building twice as many Monarch lathes in 1942 as in 1941, you'll find no let down in Monarch quality. Their ability to do more work per day, with accuracy and precision, is being proved in thousands of plants engaged in production for Victory.

THE MONARCH MACHINE TOOL COMPANY • • • SIDNEY • OHIO



From 2½ to 3 times more barrels per day is the record of this Monarch automatic sizing lathe.

MONARCH LATHES

COVER THE TURNING FIELD

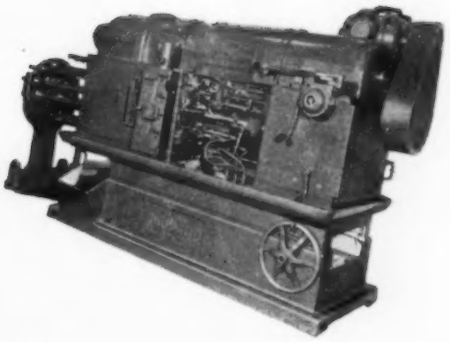
Cleveland Single Point Presses

These two Cleveland Single Point Presses, which are designed with single connections located in the center of the slides, are typical of this Modern line which also embraces Two Point Presses having two connections and Four Point Presses having four connections, and each of the three types can be furnished in sizes and capacities to suit particular requirements.

The design of these Modern Cleveland Presses not only contributes to greater rigidity and ruggedness but to extreme accuracy in the production of duplicate parts and a considerable saving in overall floor space.

The 1-28-200 has a capacity of 200 tons while the 1-36-250 has a capacity of 250 tons.

Modern Presses **THE CLEVELAND PUNCH & SHEAR WORKS COMPANY**, *Cleveland, O.*



No pause need refresh them

When time, space and manpower are precious, the tireless performance of fast, dependable multiple spindle automatics is appreciated.

Although machines may not tire, their operators often do. Simplicity and convenience of operation are important factors of a good machine.

The Departmental Design of a Conomatic contributes much to its efficiency and ease of operation. The tooling area, work-head, overhead camshaft, and controls, are in orderly arranged units, conveniently accessible from either side of the machine.

These conveniences contribute to the effective results that good operators are getting from 4, 6 and 8 Spindle Conomatics.

Prime your production pulse by specifying CONES.

Cone Automatic Machine Co., Inc., Windsor, Vermont

IN STOCK
TO MEET URGENT WAR NEEDS

. . . A Complete Line of Low-voltage Control

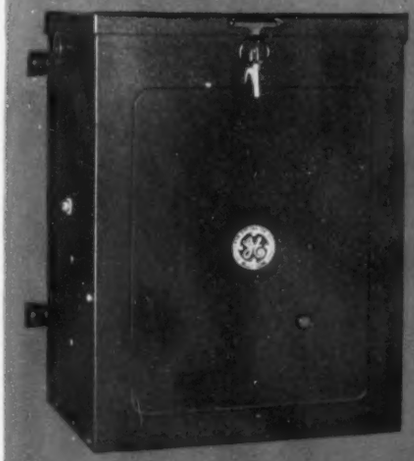
Combination starter combining NEMA size 1 starter and fusible motor-circuit switch

Magnetic motor starter, general-purpose, full-voltage, NEMA size 1

Push-button station, standard-duty, START-STOP, surface-mounted

Magnetic reversing starter, NEMA size 1

Compensator, size 1, for auto-transformer starting of squirrel-cage motors



Left—Magnetic starter, reduced-voltage, size 1

HERE'S HOW TO GET MOTOR CONTROL IN A HURRY

THE control devices shown on this page and many others in our standard line can be shipped to you directly from the stock which is carried in G-E factories and local warehouses.

To get motor control in a hurry, call your local G-E sales engineer; place your order; and give him the proper priority information. In most cases, he will be able to have your equipment on the way within 24 hours. *General Electric Co., Schenectady, N. Y.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment

GENERAL ELECTRIC

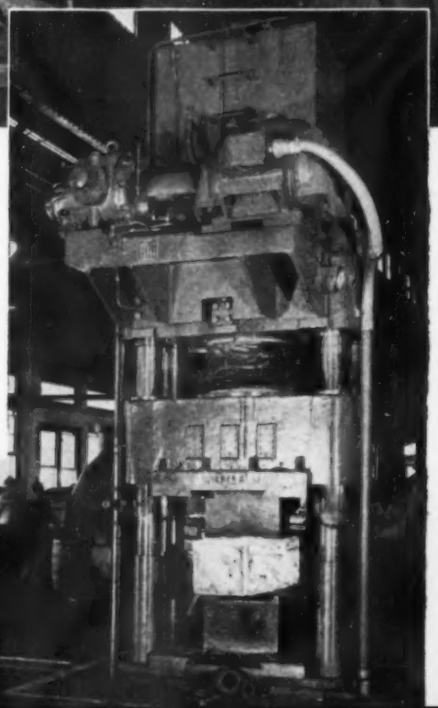
676-59-8490

This 500 Ton HPM FASTRAVERSE Forging Press is installed at the Charleston Navy Yard

HPM

FASTRAVERSE FORGING PRESSES

Cost Less to Install, Operate and Maintain

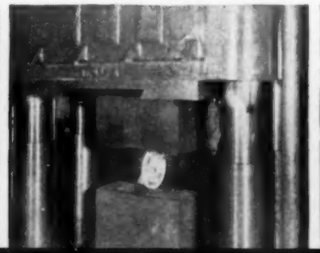


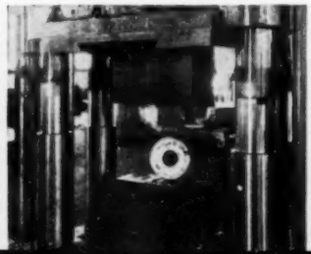
This revolutionary "All-Hydraulic" forging press has no steam boiler, accumulator or operating valves. Instead, it is completely self-contained and powered with an HPM HYDRO-POWER Radial piston type hydraulic pump mounted overhead. ● The HPM Closed Circuit operating system provides a fast press action with shockless reversal, permitting rapid planishing. Write for complete details.

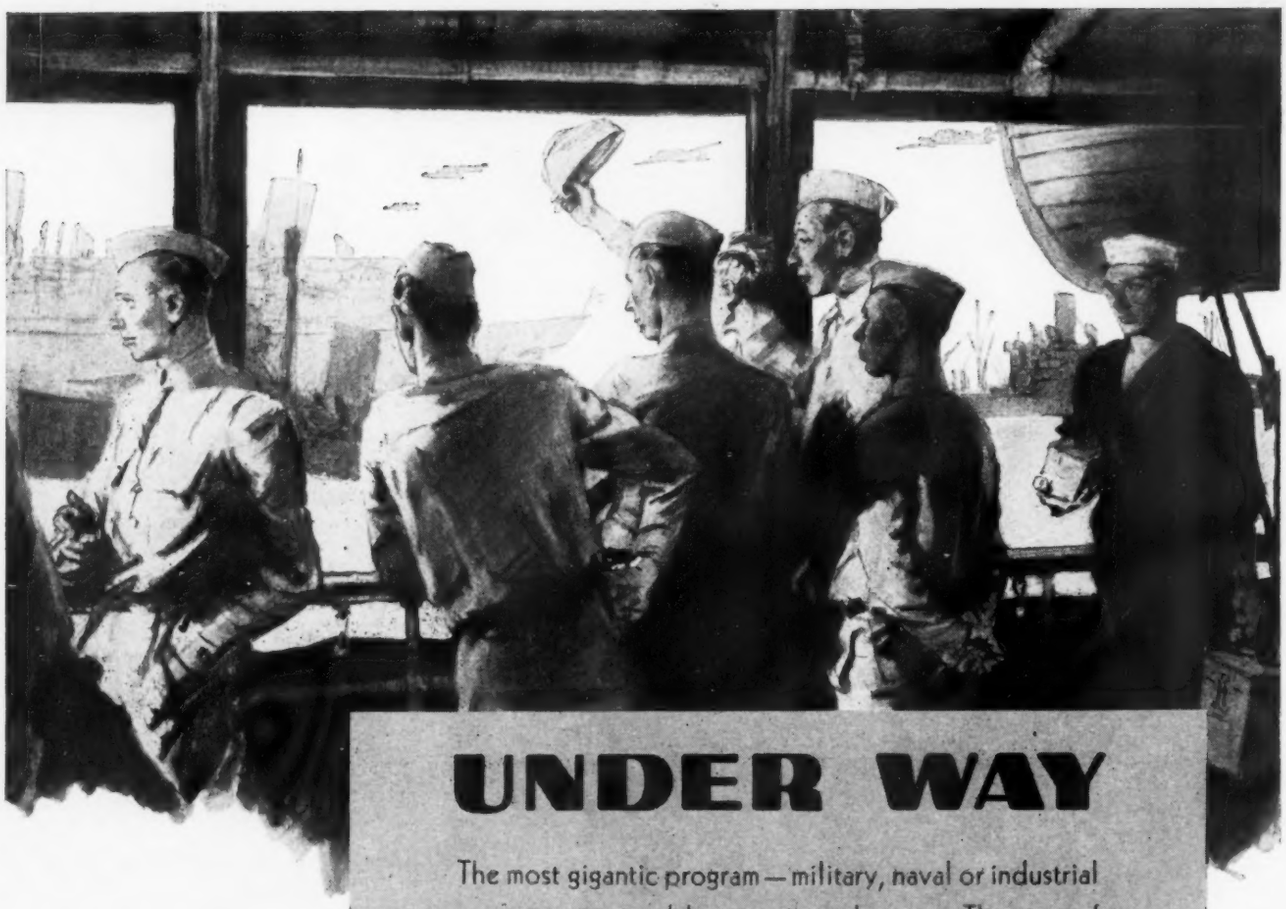
THE HYDRAULIC PRESS MFG. COMPANY

Mount Gilead, Ohio, U. S. A.

District Sales Offices: New York, Syracuse, Detroit and Chicago
Representatives in Principal Cities







UNDER WAY

The most gigantic program—military, naval or industrial—ever conceived by man is under way. The time of building factories, tooling up machines, laying out production lines is now past. The job itself is under way.

The U.S.A. is in high gear. Ships are slipping down the ways, tanks are rolling off the lines, planes are taking off from factory run-ways. American troops on the far-flung battle fronts of Democracy are getting what they need in reinforcements and armaments. The fight is getting started in earnest. It will end when Uncle Sam says it is over. Here at General Machinery the management and the men feel the rhythm and magic of well organized production. There's a stimulating swing to it that the men of industry can sense as they go about their daily tasks. We know it's here—we see it—we hear it—we feel it. America is under way.

GENERAL MACHINERY
CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.
THE HOOVEN, OWENS, RENTSCHLER CO.
GENERAL MACHINERY ORDNANCE CORPORATION

NEW VICTORIES IN "PRODUCTION NOW"

KEMPSMITH
TYPE "G" MILLER

brings new opportunities to industry for still greater production victories . . . victories assured by Kempsmith's 54 years' engineering experience and cooperation in *production now* for the immediate war program . . . victories that result from new power and speed, convenience and economy, plus precision and stamina for 24-hour days, 7 days a week! KEMPSMITH Type "G" Miller and the famous KEMPSMITH MAXIMILLER . . . plain or universal . . . are built to meet industry's needs of today and tomorrow!

KEMPSMITH TYPE "G"
UNIVERSAL MILLER
(shown above)

PRECISION
MILLING MACHINERY
Experience SINCE 1888
KEMPSMITH MACHINE CO.
MILWAUKEE • WISCONSIN

SAVINGS IN TIME, COST and LABOR

An Automatic Hob Sharpening Machine is a good investment wherever increased efficiency is desired. With this machine, hobs and cutters are *properly* sharpened under positive mechanical control, leading to longer tool life and more accurate cutting of gears and other pieces. Because of its automatic features, the machine does not require constant attention, thus giving the operator time to handle several machines or other work; furthermore, less skill or arduous training is required to operate it, as compared with conventional methods of hob and cutter sharpening. Tools can be sharpened in minimum time and at low cost, because there is no waste motion or lost effort, and because positive controls permit removal of only the necessary amount of material. Every shop, no matter what size, is urged to look into the specific advantages of installing one or more of these machines; and in this respect our representatives are ready to lend their practical experience in checking the situation and making a reasonable recommendation.

HOBS and CUTTERS SHARPENED on BARBER-COLMAN NO. 3 AUTOMATIC HOB SHARPENING MACHINE

Wright Aeronautical Photograph

FLYING FORTRESS

This famous airplane uses Wright CYCLONE engines, which are manufactured in a plant where Barber-Colman No. 3 Automatic Hob Sharpening Machines are used to sharpen a wide variety of hobs, milling cutters, form cutters, and thread mills. The quality of work done on the B-C machines is reflected in the effectiveness of this airplane as a weapon of war.

BARBER B-C COLMAN PRODUCTS

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

NEW SKILLS from VETERAN TOOLS

WHAT'S true in the Army is just as true in the shop these days. New problems demand new skills from the man and from the tools. *Adaptability* has become a highly important word.

Bullard Vertical Turret Lathes were among the first to prove their fitness for wartime service. These veterans of fast production go right ahead handling such jobs as compressor cylinders and pipe flanges, or switch to airplane and tank parts. Five tooling stations on the main turret and four tools on the side head permit nine different operations at one chucking—two heads cutting simultaneously.

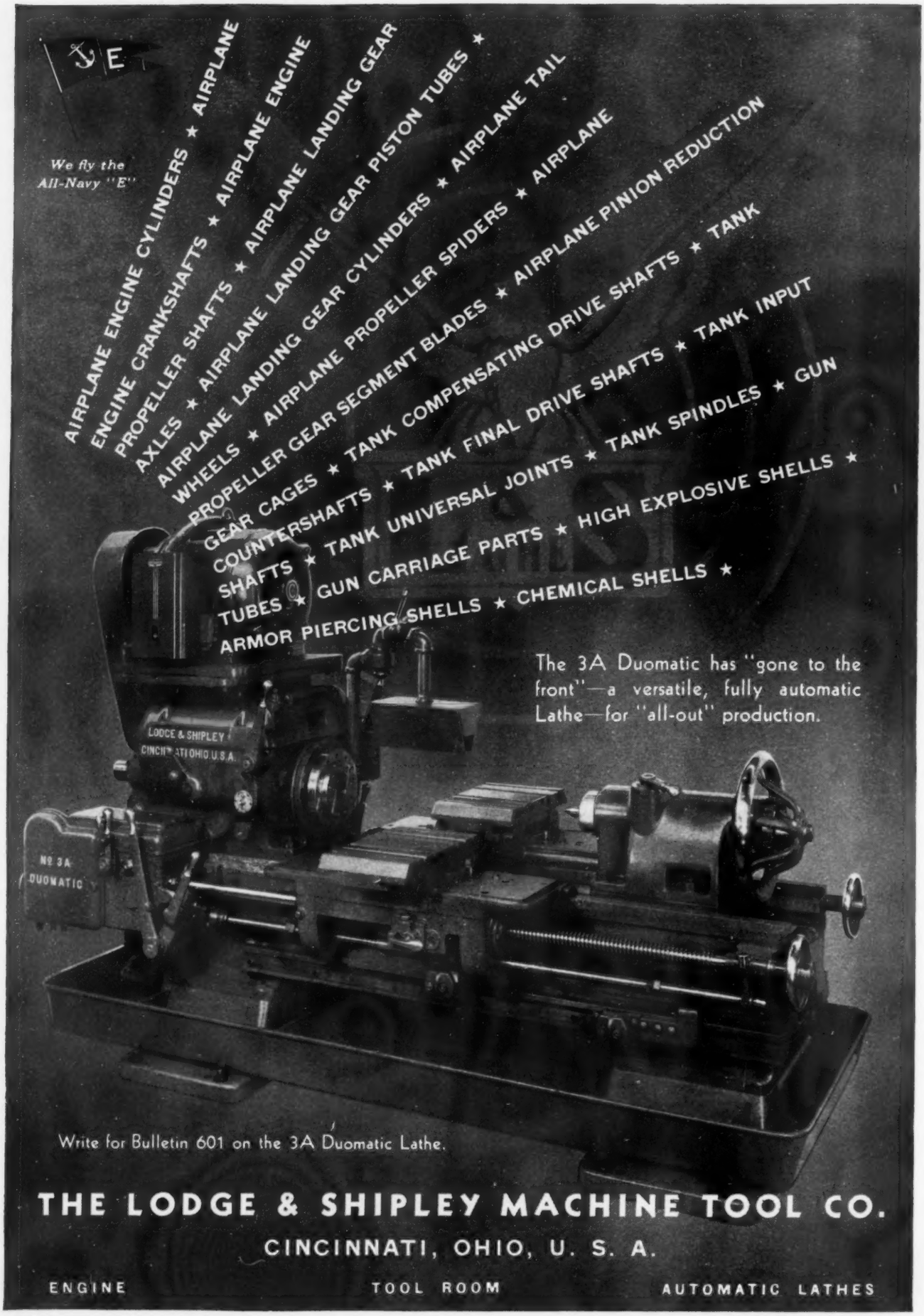
Use your Bullard V. T. L. for every job you can find—use it to its utmost capacity. Our field engineers will help you.

Bullard V.T.L.s have these characteristics

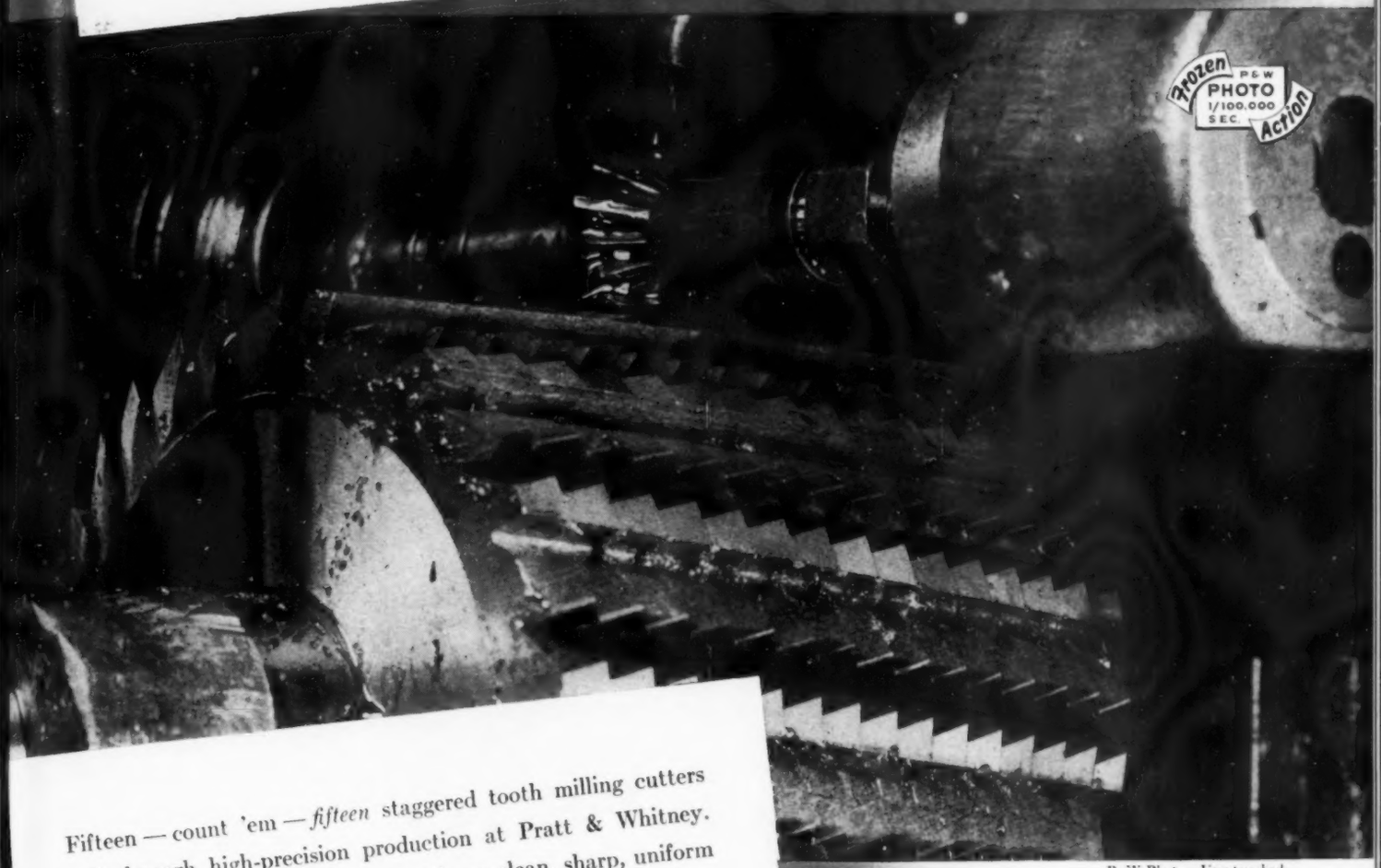
Vertical Design • Rigidity and Power for Carbide Tools • 5-Face Turret on Main Head • Centralized Control • Rapid Power Traverse of Main Head • 4-Tool Turret on Side Head • Simultaneous and Independent Head Functions

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT


We fly the All-Navy "E"
AIRPLANE ENGINE CYLINDERS ★ AIRPLANE ENGINE CRANKSHAFTS ★ AIRPLANE ENGINE PROPELLER SHAFTS ★ AIRPLANE LANDING GEAR AXLES ★ AIRPLANE LANDING GEAR PISTON TUBES ★ AIRPLANE LANDING GEAR CYLINDERS ★ AIRPLANE TAIL WHEELS ★ AIRPLANE PROPELLER SPIDERS ★ AIRPLANE PROPELLER GEAR SEGMENT BLADES ★ AIRPLANE PINION REDUCTION GEAR CAGES ★ TANK COMPENSATING DRIVE SHAFTS ★ TANK COUNTERSHAFTS ★ TANK FINAL DRIVE SHAFTS ★ TANK INPUT SHAFTS ★ TANK UNIVERSAL JOINTS ★ TANK SPINDLES ★ GUN TUBES ★ GUN CARRIAGE PARTS ★ HIGH EXPLOSIVE SHELLS ★ ARMOR PIERCING SHELLS ★ CHEMICAL SHELLS ★
The 3A Duomatic has "gone to the front"—a versatile, fully automatic Lathe—for "all-out" production.
LODGE & SHIPLEY
CINCINNATI OHIO U.S.A.
No 3A DUOMATIC
Write for Bulletin 601 on the 3A Duomatic Lathe.
THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U. S. A.
ENGINE
TOOL ROOM
AUTOMATIC LATHES

Let 'em try to find aid or comfort here



P&W Photo—Unretouched

Fifteen — count 'em — *fifteen* staggered tooth milling cutters roll through high-precision production at Pratt & Whitney. Stacked on one arbor, they are getting a clean, sharp, uniform trim with the speed and certainty only a Pratt & Whitney cutter — mounted above — can deliver.

The day after this batch of cutters was finished — milled, hardened, ground, perfected to P&W's high standard of accuracy — they were on the job producing for Victory.

Let Hitler and his little yellow confederates try to get aid out of the knowledge that these P&W small tools, and thousands more daily, are swelling America's military might.

Let 'em try to get comfort out of our advice to P&W equipment users:

Work your P&W tools 24 hours a day . . . don't spare the pressure . . . they can take it.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

West Hartford, Connecticut

THE R. K. LEBLOND MACHINE TOOL CO.
ARMY
E
NAVY
ARMY-NAVY
"E"
AWARD
SEP. 8, 1942
Above, U. S. Army officers lead the parade before the ceremony.
Below, LeBlond workers and their guests completely fill the court in front of the speakers' stand.
Above, Brigadier General Wm. Ord Ryan, Lieut. Comdr. Wm. C. Duval, and Governor John W. Bricker of Ohio were three of the principal speakers.
Below, the speakers' stand.
"Well done!" you say... "well done!"?
"Well, thanks a million, mister,
But we've only just begun!"

More Production of ITI-AIRCRAFT AMMUNITION y using HARDINGE ECOND OPERATION MACHINES

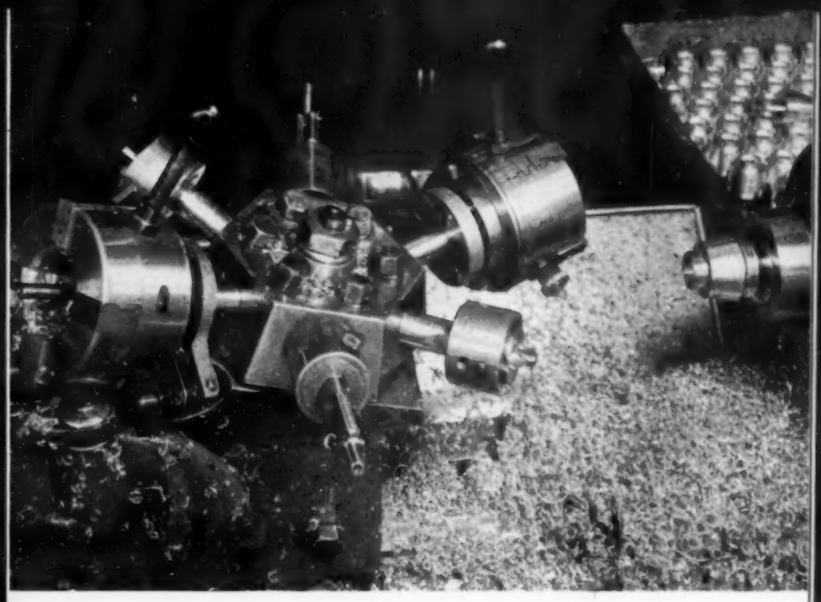
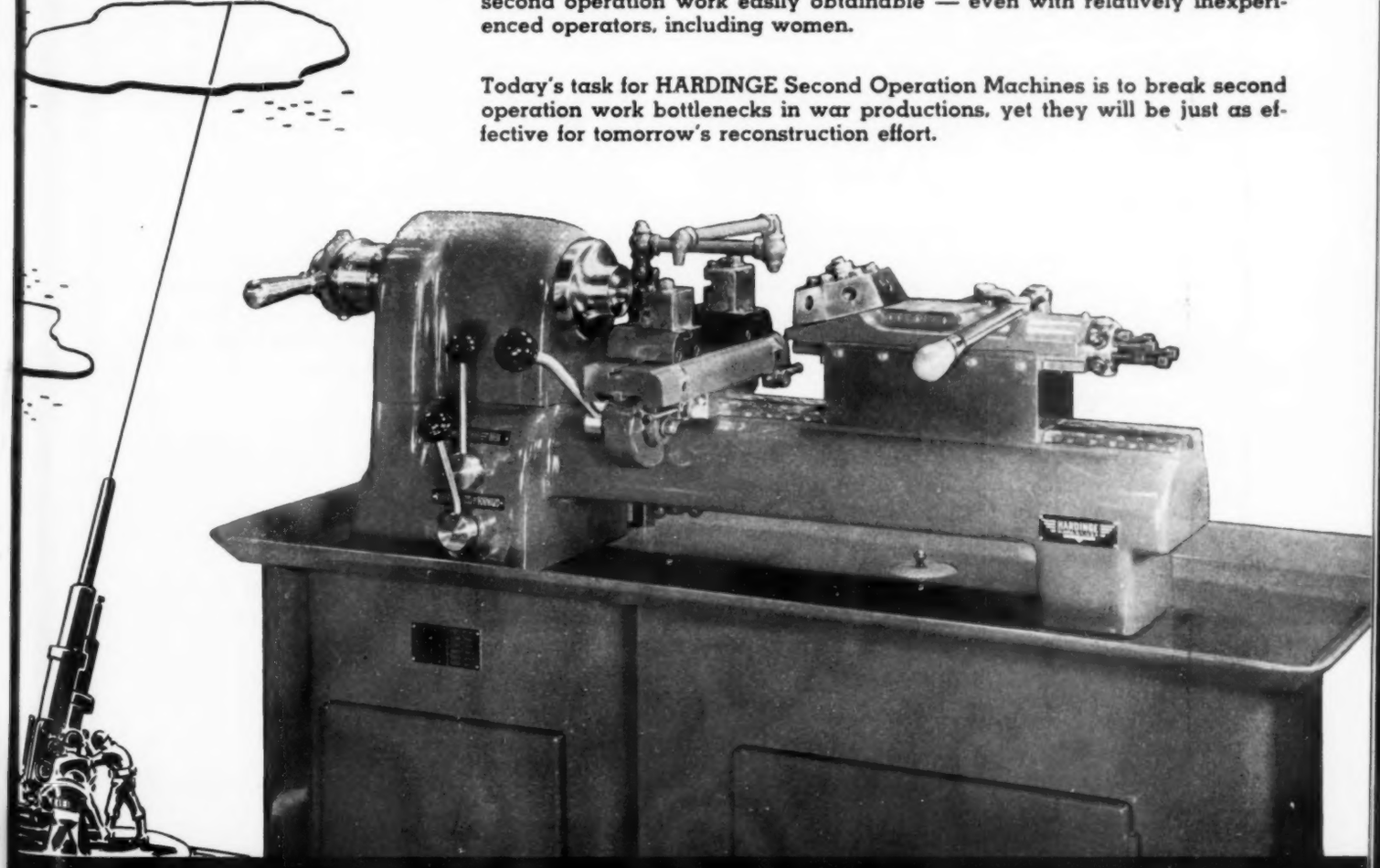


Illustration shows rear view close-up of a HARDINGE Second Operation Machine tooled for a fuse part. Greater production was obtained by taking the threading operations from the automatics and completing them with relative ease on this machine.

The army of HARDINGE Second Operation Machines daily concentrates on a single objective—More Production! These machines are effectively backing up the armed forces of the United Nations by making fast, precise second operation work easily obtainable — even with relatively inexperienced operators, including women.

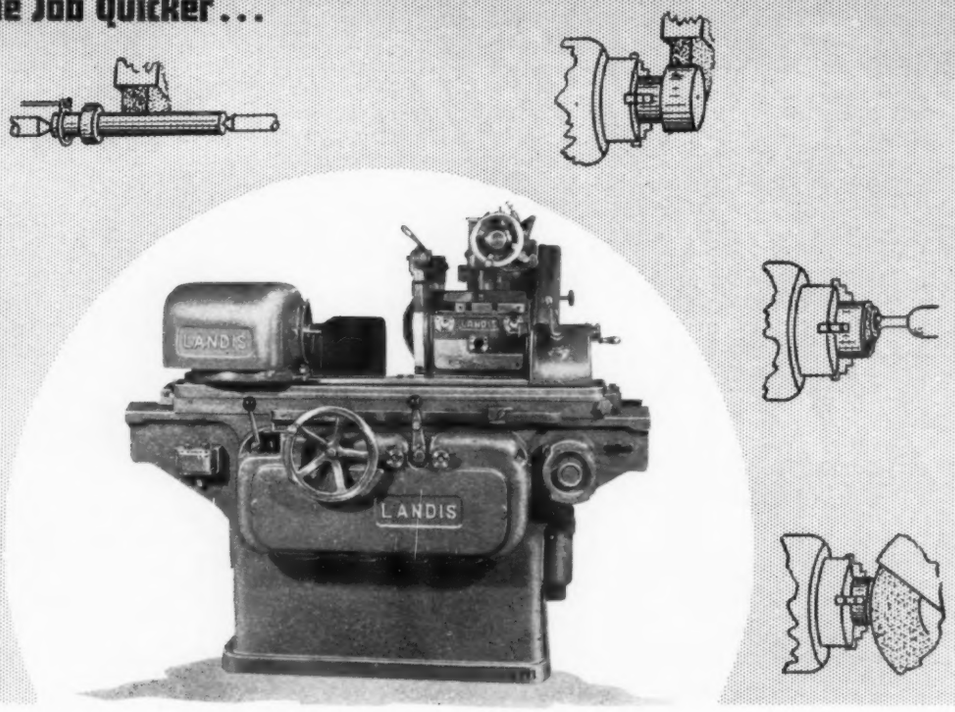
Today's task for HARDINGE Second Operation Machines is to break second operation work bottlenecks in war productions, yet they will be just as effective for tomorrow's reconstruction effort.



HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

To Finish The Job Quicker . . .



EMPLOY THE ALL-AROUND VERSATILITY OF THE 10" x 24" TYPE C UNIVERSAL

It is almost trite to say that industry's main goal at the moment is more and more production. This, however, does not necessarily mean that heavier, more specialized equipment must be used in order to achieve the desired results.

With this in mind, grinding machine users might well consider the Landis 10" x 24" Type C Hydraulic Universal grinder. Certainly it is heavy and rugged enough to turn out work rapidly. It's modern in every respect. But above all this, its versatility is just what many grinding departments need.

Suppose you wish to grind successive lots of work requiring (1) conventional between center handling, (2) chucking for an external operation, (3) an internal operation, (4) face grinding with the work head swiveled up to 90°, (5) a magnetic chuck for holding during face grinding and (6) a loose cam operation. With certain items of easily applied extra equipment, the Landis 10" x 24" will handle them all.

Check the advantages of this modern universal before you purchase your next grinder intended for the handling of smaller parts. Like hundreds of others, you may find it the very machine to take over that extra load in your grinding department.

Unusual Performance As Usual

PRECISION LANDIS GRINDERS

LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA.

LANDIS EXCELLENCE

CONTRIBUTES TO VICTORY

404

EFFICIENCY– Not Emergency–

Is Dictating the Swing to Bonded Lapping Stones

More and more, manufacturers of precision parts are turning to bonded abrasive lapping stones. More and more, bonded abrasive lapping stones are replacing the more conventional cast iron lapping blocks.

Instinctively, in times like these, you'll say: "It's the war and the shortage of metal." But that's not entirely true.

Bonded abrasive lapping stones have earned a place in the shop purely on their own record. Developed long before the shortage of metal became acute, abrasive lapping stones have proven their worth over and over again. Naturally, the current shortage of metal has accelerated the speed with which discerning production men have adopted this comparatively new lapping practice. But, even so, no one can ignore the fact that bonded abrasive lapping stones will:

1. **REMAIN FLAT FROM TWO TO THREE TIMES LONGER THAN CAST IRON BLOCKS.**
2. **RE-FLATTEN MUCH EASIER THAN CAST IRON BLOCKS.**
3. **ELIMINATE ALL POSSIBILITY OF CHARGING THE WORK WITH LOOSE ABRASIVE, THUS CAUSING FRICTION WHERE ULTRA-SMOOTHNESS SHOULD PREVAIL.**

Those are the principal reasons behind the switch to abrasive lapping stones. In other words, efficiency — not emergency — is dictating the change.

The Mid-West Abrasive Company has pioneered the trend toward refined honing and superfinishing of working parts. MID-WEST lapping stones, like MID-WEST honing and superfinishing stones, are made with MICRO BOND, the remarkable new abrasive developed by MID-WEST engineers that has created new standards in precision manufacturing practices.

Although MID-WEST honing, superfinishing and lapping stones cost more than average abrasives at the outset they are more economical in the long run because they last longer, perform more efficiently, leave a finer, more precise finish and result in fewer rejects. Our engineers — located in all large cities—are eager to prove these claims.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE DETROIT, MICHIGAN

Mid-West

★ *Honing Stones*
★ *Superfinishing Stones*
★ *Grinding Wheels*
★ *Emery Cloth*
★ *Sandpaper*

Mid-West Abrasive Company,
1960 E. Milwaukee Avenue,
Detroit, Michigan

Gentlemen: Please send me additional information on Mid-West Micro Bond honing and superfinishing stones.

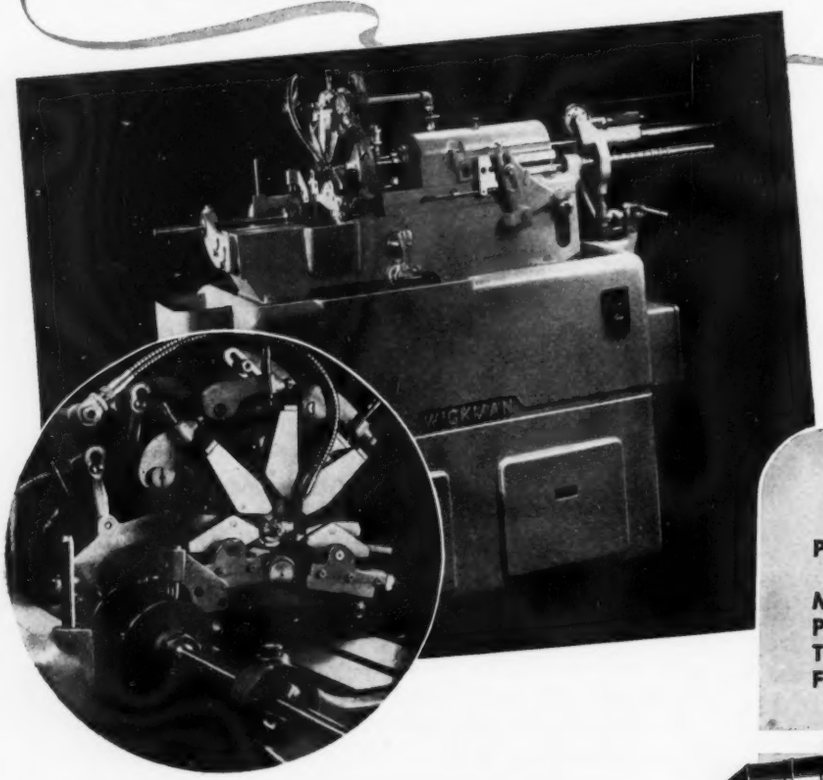
*Name*_____

*Company*_____

*Address*_____

_____

EXTREME ACCURACY—HIGH FINISH



On Work Up to 1/2" Diameter and 4" Length

Part—3/4" long—six diameters—1/2" to 3/16"
Material—S.A.E. 1114 Steel
Production—100 per hour
Tolerance—±.0003" on all diameters
Finish—30 to 50 Micro inches

Part — 3" long — twelve diameters and two pivot points between 7/16" and 3/16"
Material—Black—Red Stainless Steel
Production—14 per hour
Tolerance—±.0003" on all diameters
Finish—15 to 40 Micro inches

Part—3-7/8" long—five diameters between 1/4" and 5/32", two undercuts, one taper
Material—Black—Red Stainless Steel
Production—24 per hour
Tolerance—±.0003" on all diameters
Finish—25 to 50 Micro inches

Pictured in actual size are three parts, each completed in one operation on the WICKMAN High Precision Automatic. They are typical of many small, accurately finished parts which can be produced from bar stock on a high production basis.

Five individually cam-fed single point tools are employed. All tool holders are provided with both radial and lateral micrometer adjustments. By synchronizing the sliding headstock movement with the radial strokes of the tool slides, there is no limitation to the back shoulder work which can be done. 28 spindle speeds up to 7000 R.P.M. and infinite feed rates are available.

Various attachments for drilling, threading, tapping and slotting may be furnished. Write for full details.

WICKMAN HIGH PRECISION AUTOMATIC

(SWISS TYPE)

THE Wickman CORPORATION

15539 WOODROW WILSON AVE.
DETROIT, MICHIGAN

In Canada—A. C. Wickman Ltd., Toronto; West Coast—Moore Machinery Co., Los Angeles, San Francisco—Branch Offices—Chicago, Hartford.

UNION

Union Butterfield Card

Divisions of the UNION TWIST DRILL CO.

UNION TWIST DRILL CO.
ATHOL, MASS.

S. W. Card Mfg. Co. Div., Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
Butterfield Div., Rock Island, Quebec.

STORES

New York: 61 Reade St.
Chicago: 11 So. Clinton St.
Detroit: 6540 Antoine St.
San Francisco: 121 Second St.
Los Angeles: 524 E. Fourth St.
Seattle: 568 First Ave., South

OUR 68th YEAR OF SERVICE

Since 1874, Card has studied the problems of efficient threading. Today, with war production demanding high accuracy and continuous operation at high speeds, our 68 years of experience becomes an invaluable asset. Let us study your problems and make suggestions on preliminary drilling and reaming, thread depth, lubrication and all the fine points of tapping that will enable you to get the best service from Card Taps on every war production threading job.

QUALITY TAPS Since 1874

Divisions of the UNION TWIST DRILL CO.

Union Butte

S. W. CARD MFG. CO.
MANSFIELD, MASS.

STORES

New York 61 Reade St.
Chicago 11 So. Clinton St.
Detroit 6540 Antoine St.
San Francisco 121 Second St.
Los Angeles 524 E. Fourth St.
Seattle 568 First Ave. South

COUNT ON

Butterfield

FOR PRODUCTION!

With plant capacities being taxed to the utmost, big responsibilities rest on small tools. Production men know that Butterfield Taps and Reamers can be depended upon to get maximum efficiency from their machine tools . . . to insure accurate, high-quality production on important defense jobs. Today—when production and accuracy are so vitally important—count on Butterfield!

tterfield Card

O. BUTTERFIELD DIVISION

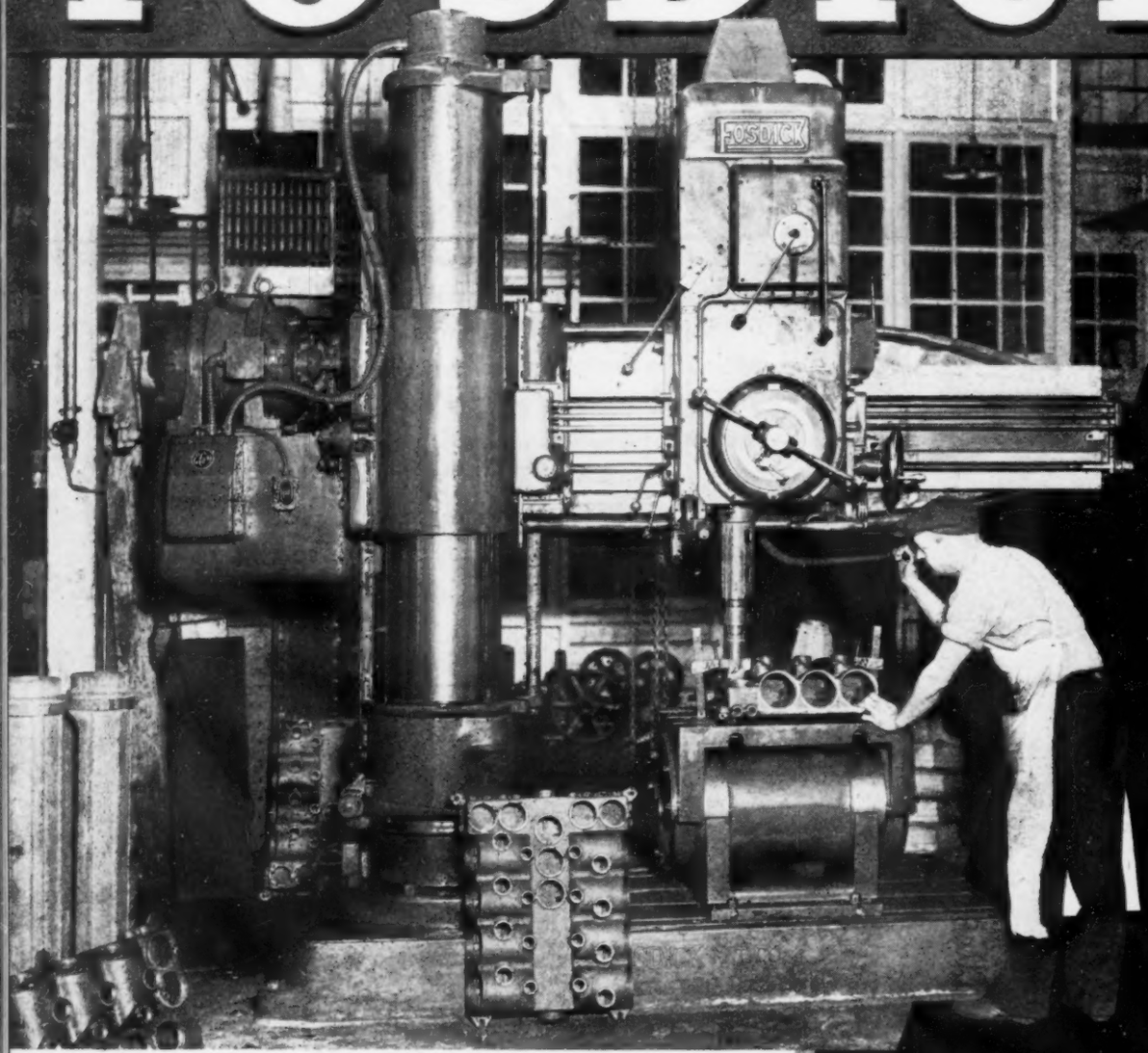
DERBY LINE, VT. **ROCK ISLAND, QUE.**

STORES: New York, 61 Reade St. Chicago, 11 So. Clinton St. Cleveland, Hal W. Reynolds, 3346 Superior Ave. Detroit, 6540 Antoine St. Los Angeles, 524 E. Fourth St. Toronto, 208 King St., West. Montreal, 111 St. Paul St., West. Winnipeg, 403 Travellers Bldg. Vancouver, 327 Shelly Bldg. Agents for Great Britain—Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S. E. 11, England. Branches at Birmingham, Manchester, Glasgow, Newcastle-on-Tyne and Bristol.

Divisions of the

UNION TWIST DRILL CO.

FOSDICK



4 OPERATIONS — 23 HOLES — 3 DIFFERENT DIAMETERS
Completed at one setting

It is this versatility plus ample power and concentrated controls that makes Fosdick Radials popular on the tough jobs.

On the work shown eight 1 inch diameter holes are reamed and threaded . . . eight 1-¾ inch holes bored, faced and threaded . . . seven 3-⅛ inch holes bored, faced and threaded—all at one setting in one hour and 30 minutes.

Today in hundreds of War plants—24 hours a day — Fosdick Radials are performing important operations on badly needed equipment for our fighting forces.

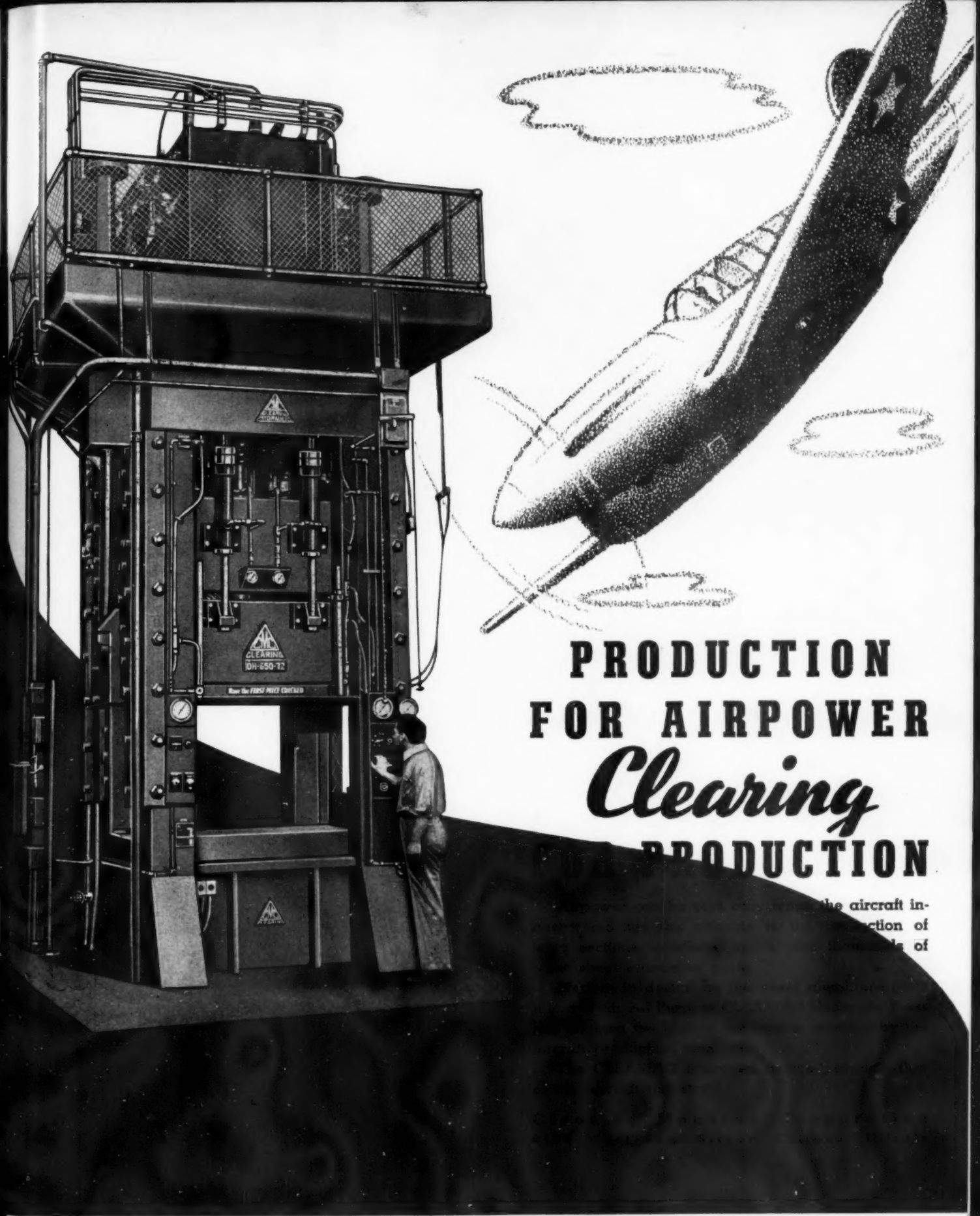
Whether your work requires one operation or a dozen you can do them faster and better on a Fosdick Economax Radial. Write for Fosdick Radial bulletin AR for complete information.

ECONOMAX *Hydraulic* RADIALS

HYDRAULIC VARIABLE RAPID TRAVERSE TO HEAD

HYDRAULIC COLUMN CLAMP

FOSDICK MACHINE TOOL COMPANY
CINCINNATI · · · OHIO



PRODUCTION FOR AIRPOWER

Clearing

PRODUCTION

...the aircraft in-
...ction of
...ds of

MECHANICAL AND HYDRAULIC PRESSES

CLEARING

MACHINE CORPORATION

CHICAGO

Sure, IT TAKES SKILL, *but*

GISHOLT

LOOK AHEAD • KEEP AHEAD
with
GISHOLT IMPROVEMENTS
in metal turning

THE GISHOLT SIMPLIMATIC is the kind of machine that makes high production look very easy. That's because the machine itself does so much, the operator so little.

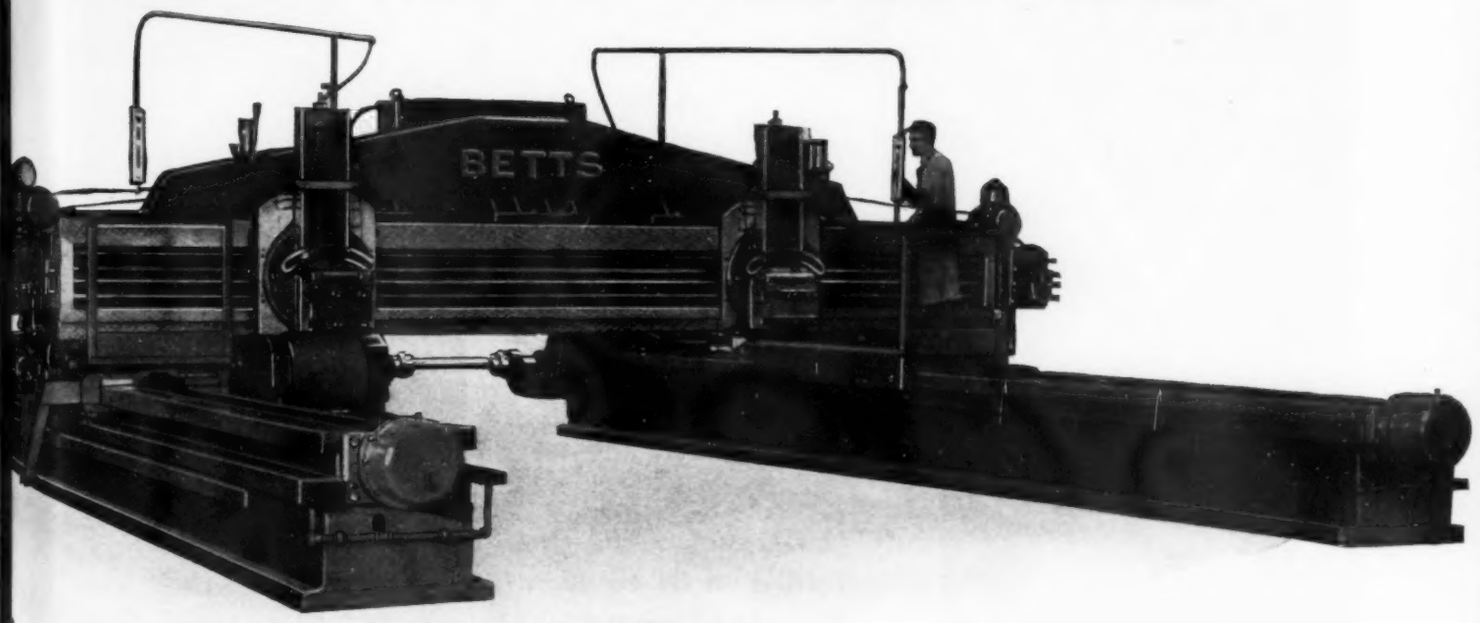
Once tooled for the job, this accurate, multiple-cutting lathe functions automatically, with the operator merely loading and removing the work.

Of course, it takes *some* training to run a Gisholt Simplimatic—but the average man (or woman) learns how to tend this automatic lathe within a very short time.

GISHOLT MACHINE COMPANY, 1201 *E. Washington Ave., Madison, Wis.*

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

"A LIFE SAVER"



That's the way one of these machines was referred to recently in one of the large defense plants where one was installed last February.

They said, "We would not know what to do without this Planer, it certainly is a life saver."

BETTS PIT TYPE PLANERS

are life savers in our war effort because of the variety of large work they will handle efficiently and the speed with which they can be built.

Information on these Planers will be furnished on request.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

Grinding bearing caps on the Blanchard No. 18 Surface Grinder.

THE surfaces on these bearing caps were formerly milled in 34 to 40 minutes each — now they are Blanchard ground at the rate of 7 pieces per hour. The Blanchard No. 18 not only increases production, but decreases setting-up time and eliminates expensive fixtures.

The caps are laid on two parallel bars on the chuck. Smaller steel blocks are laid on top of them and against the caps. Two hollow steel rings against these blocks serve to hold the work sideways. A steel block is placed at each end and the magnetism is turned on.

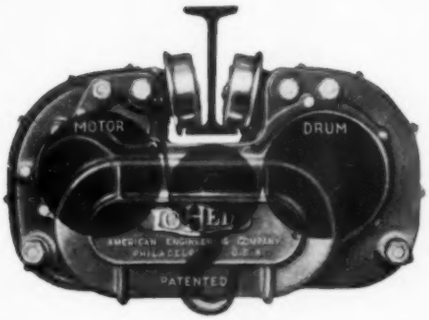
¼″ of stock is removed from the cast iron bearing caps to limits of +.010″.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

BLANCHARD

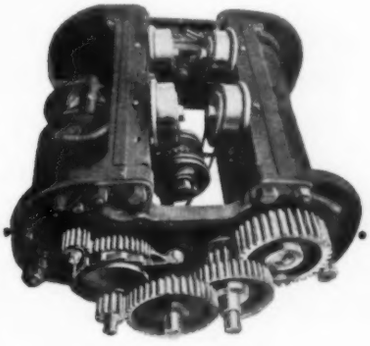
Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



It took BALANCE to create this electric hoist

In a hoist, balance is mighty important for good operation. The Lo-Hed hoist was the first to achieve balance in a new way. It was the first hoist designed around the supporting beam . . . first to place motor and drum on opposite sides of and parallel to the beam . . . first to draw the hook up close to the beam . . . first to use a straight-line all spur gear drive. Time and time again, Lo-Hed has been called the "most logically designed hoist".

Lo-Hed is ingeniously compact yet its working parts can be reached in a jiffy. Spur gear efficiency needs no introduction to you. Low headroom is there when you want it at no extra premium. Gear shafts and trolley wheels are equipped with ball or roller bearings. The motor is a heavy-duty hoist motor. The Lo-Hed hoist is a brute for punishment, as service records show. And we're building it today with the same fine precision and quality materials as always—to last for years to come. Write for the Lo-Hed catalog.



AMERICAN ENGINEERING COMPANY

The Lo-Hed Hoist Is Applicable To Any Monorail System
There's A Balanced Lo-Hed Electric Hoist For Every Purpose

•

Look in your Classified Telephone Directory under "A-E-CO LO-HED HOISTS" for your nearest representative

•

OTHER A-E-CO PRODUCTS: **TAYLOR STOKERS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER**

AMERICAN ENGINEERING COMPANY
2407 Aramingo Avenue, Philadelphia, Penna.

☐ Please send me your complete catalog of LO-HED HOISTS
☐ Ask your representative to get in touch with me promptly

Name_____

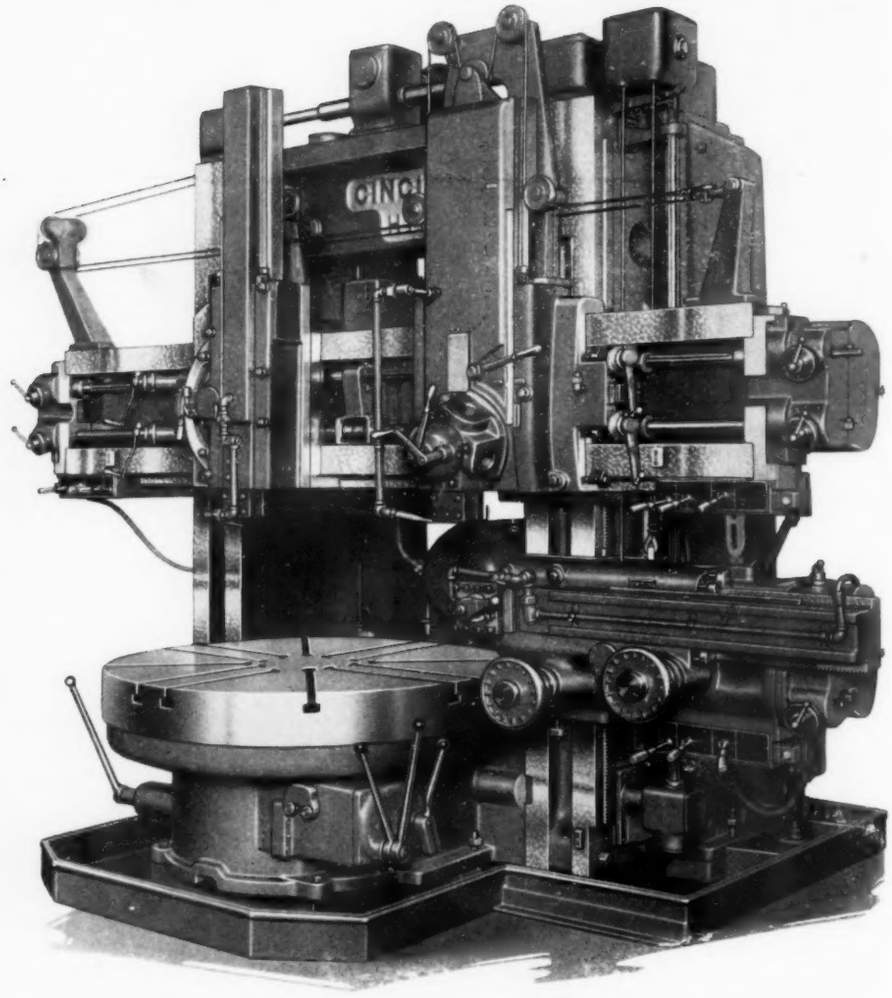
Company_____

Street Address_____

City_____ State_____
(Please Print Plainly)

CINCINNATI

54" HYPRO VERTICAL BORING MILL



This boring and turning mill has been completely redesigned and now has all the big Hypro features. The bed and speed box are of one-piece construction with double wall reinforced with heavy radial ribs. These are extremely rigid insuring a perfectly smooth cut when machining work of all classes at the machine's full capacity.

Pyramid type massive housings with a broad face and unusually long base insure rigidity under the most severe duty. The square type housings provide a sheath for both the rail head and side head counterbalance weights.

»

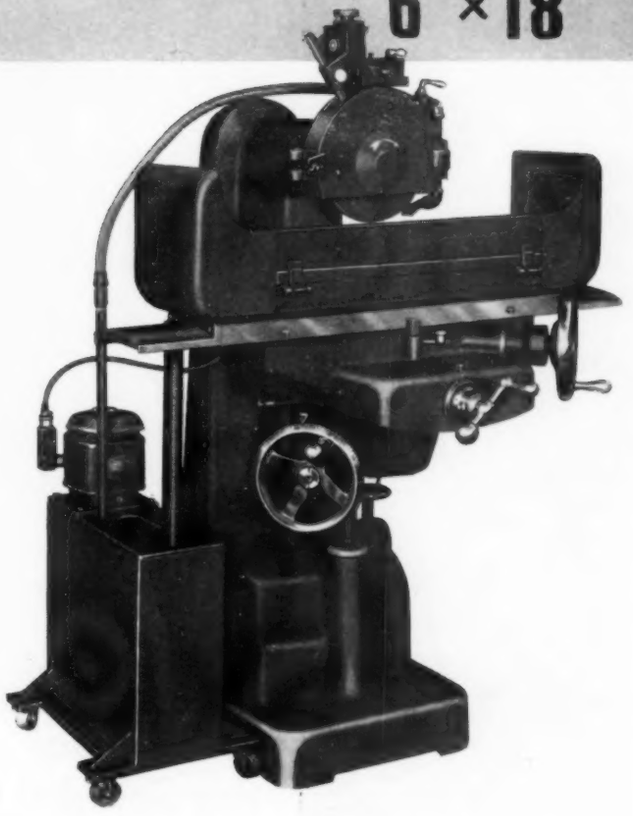
WRITE FOR BULLETIN 130

THE CINCINNATI PLANER COMPANY
Planers...Vertical Boring Mills...Planer Type Millers
CINCINNATI . OHIO . U.S.A.

PROMPT DELIVERY

No. 15 SURFACE GRINDER

6" × 18"



Because your War Work can't wait, Covel is in continuous production on this No. 15 Hand Feed Surface Grinder. Ideal for quick set-ups where hand feed control gives desired flexibility. These features, plus low initial cost, make this accurate machine a natural addition to your production line or tool room.

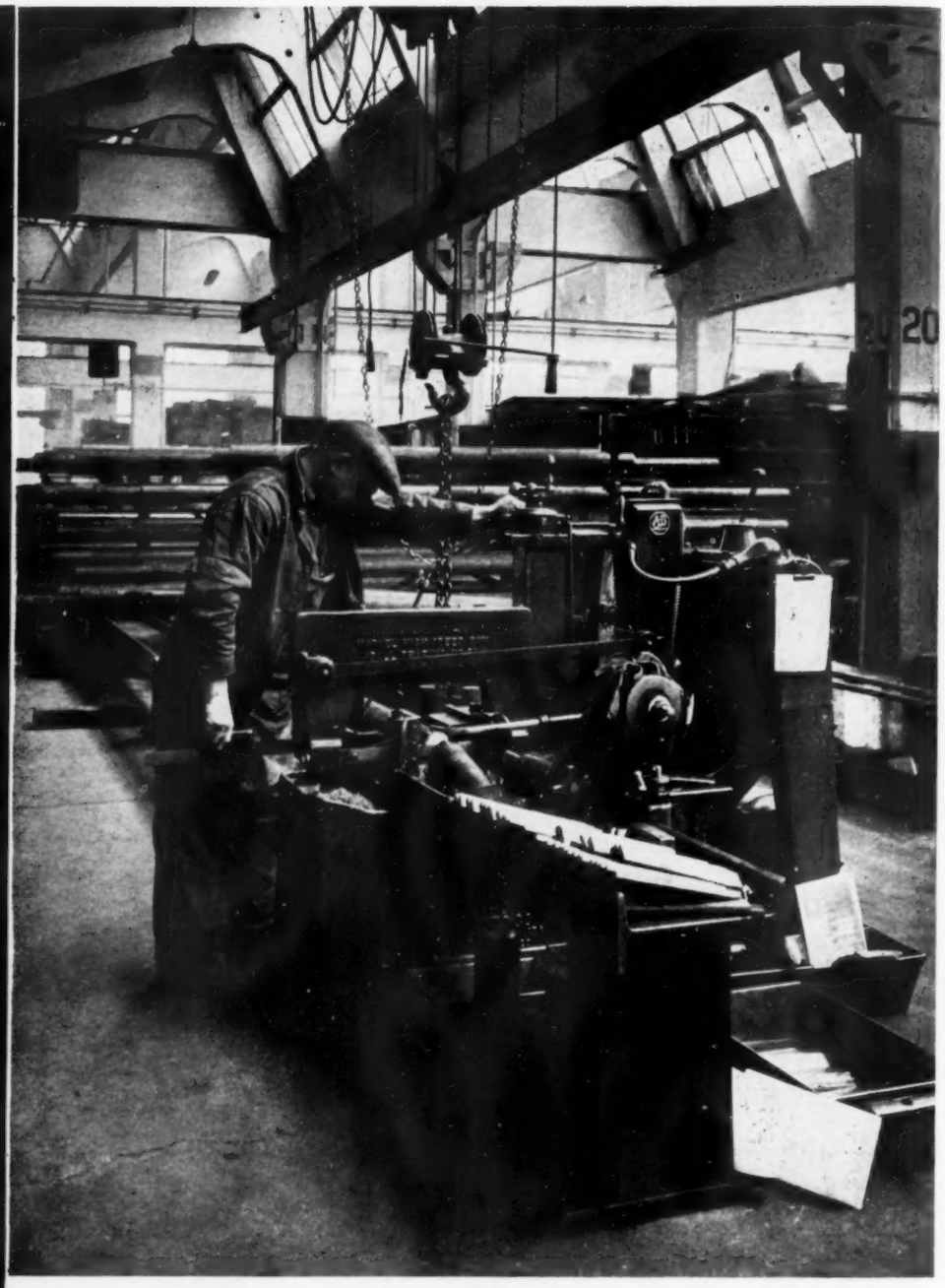
NOW—PROMPT DELIVERIES TO WAR PRODUCTION PLANTS.

Write, wire or phone for Bulletin A102, and name of nearest dealer.

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.



In constant service 48 hours per week at the Gould & Eberhardt plant, Irvington, N. J.

Purchased by Gould & Eberhardt, Irvington, N. J., manufacturers of gear cutting machines and shapers, to speed up cutting-off from bar stock on various grades of steel up to 6" in diameter, this MARVEL 6A high speed Production Saw has been operating 48 hours per week since installation over a year ago. When photographed it was automatically cutting identical lengths from "Maxwell" # 3½ hot rolled natural steel 2⅝" diameter. The actual cutting time per piece, using a 6 tooth MARVEL High-Speed-Edge Hack Saw Blade, was 1 minute 15 seconds per piece.

ARMSTRONG-BLUM MANUFACTURING CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVE. CHICAGO, U. S. A.

Eastern Warehouse & Sales: 225 Lafayette St., New York, N. Y.

MARVEL SAWS

use emergency motor power NOW

. . . and save critical materials!

In peacetime, motors are applied with a substantial reserve safety factor. In other words, most applications are "overmotored" . . . the motors are capable of producing more horsepower than is required by the machines they drive.

Such "overmotoring" provides a reserve to take care of unexpectedly heavy loads, and assures long life with low maintenance cost.

But today, our problem is to "make the most of what we've got"—to get more production out of each and every motor—and to save critical materials.

Recognizing this fact, Westinghouse, at the suggestion of the War Production Board, now recommends that motor users modify their peacetime practices . . . that they get the most out of every motor they have . . . that in applying new motors or relocating old ones, they take advantage of all possible favorable operating conditions . . . that they load each motor to the limit.

J-21255

for THIS LOAD	*use* THIS RATING	*instead of* THIS RATING	*save these* MATERIALS
hp	**hp**	**hp**	**lbs.**
1.25	1.	1.5	36
1.88	1.5	2.	14
3.75	3.	5.	19
6.25	5.	7.5	63
9.38	7.5	10.	80
25.	20.	25	106
37.5	30.	40	186
62.5	50.	60.	320
125.	100.	125.	550

Recommendations in this table apply to open-type A-C motors, 40°C rated, in applications seldom reaching or exceeding this temperature

Westinghouse

SEND FOR THIS BOOK

Today A summary of Westinghouse wartime motor recommendations is presented in the booklet "Calling All Horsepower."

Write today for your free copy. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

American Engineering Achievement

The supremacy of American built planes is a tribute to the skill and inventive genius of American designers and mechanics. But this alone would be insufficient for victory. Vast production is needed to answer the call from the battle fronts of the world. In the Fenn plant tool makers and machinists are contributing their expert skill to the accurate, fast production of essential war material. Keep the name FENN in mind for machines and tools, design and development — in the days that are sure to come.

OFFICIAL U. S. NAVY PHOTOGRAPH

FENN

THE FENN MANUFACTURING CO.

HARTFORD, CONNECTICUT • ESTABLISHED 1900

AUTOMATIC CHUCKING EQUIPMENT

PROVIDES VASTLY STEPPED UP PRODUCTION IN RESPONSE TO URGENT NEEDS

PHOTO BY U. S. ARMY SIGNAL CORPS

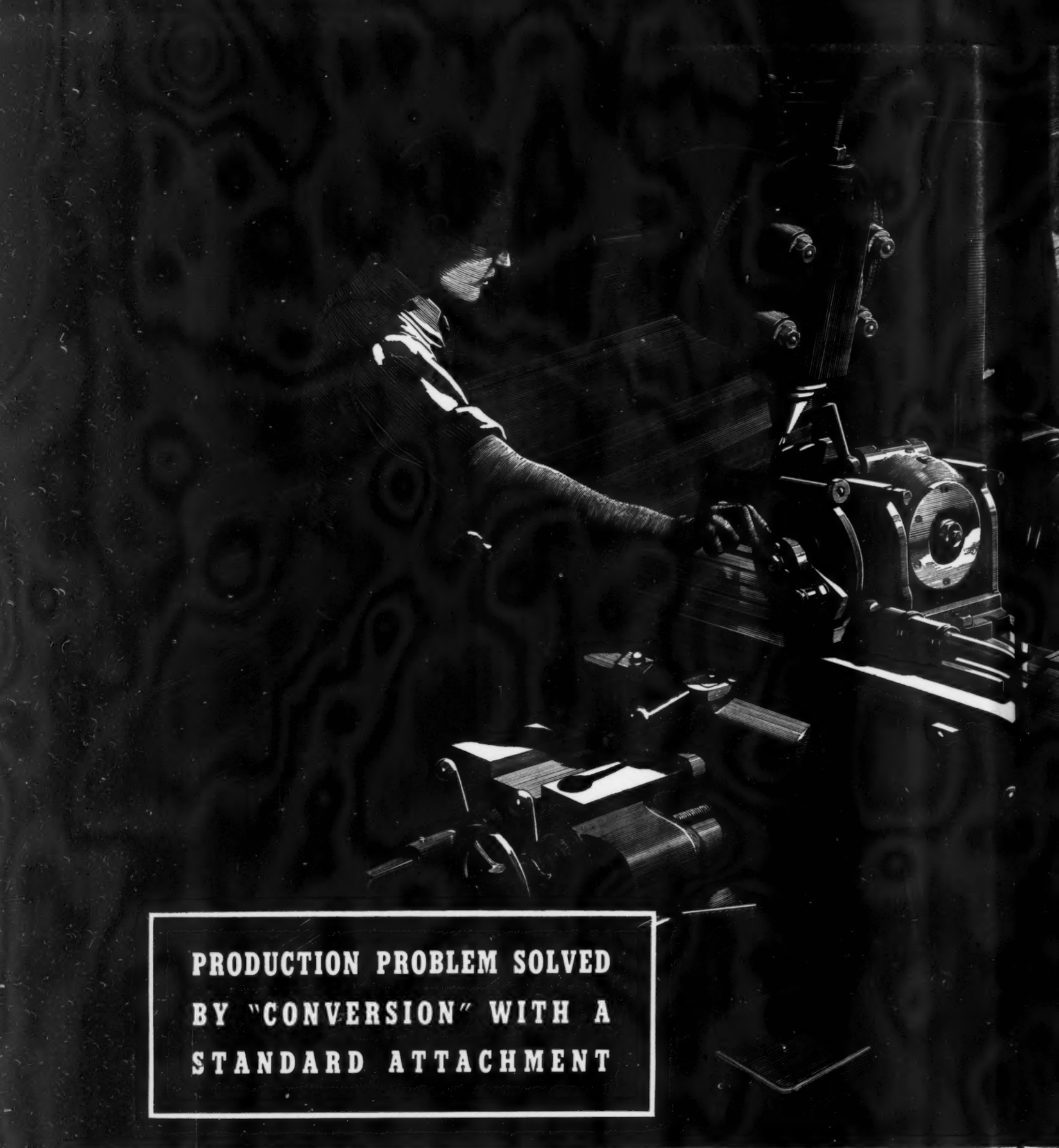
Increased output of parts for airplanes, airplane engines, machine guns, anti-aircraft guns, Bofors guns, American Oerlikon guns and other emergency needs is being realized by Potter & Johnston Automatic Chucking Machines in the nation's arsenals of democracy.

These machines, operating steadily around the clock, are tooled for top production and are turning out parts which meet the most rigid specifications for accuracy and finish.

If you are striving for greater production, P&J engineers are ready to study your problem and offer suggestions for solving it. If it is possible for floor-to-floor time to be reduced, P&J will find the way to do it because more parts in less time is a P&J specialty.

THE POTTER & JOHNSTON MACHINE CO.

PAWTUCKET, R. I.



PRODUCTION PROBLEM SOLVED BY "CONVERSION" WITH A STANDARD ATTACHMENT

Here is another instance where a standard Milwaukee attachment cracked a troublesome production problem.

Wartime secrecy demands that we do not reveal the name of the plant concerned and the machining operation involved, but the basic facts can be presented.

A large manufacturer was faced with the problem of vertical milling tank parts for a new production schedule. His vertical milling machines were all busy on other jobs and his schedule would not allow sufficient time for the purchase of additional vertical millers. But he did have some horizontal milling machines which could be quickly adapted to vertical milling.

The manufacturer wired our Emergency Production Service Department. One of our field representatives recommended and arranged for prompt delivery of some Universal Milwaukee Milling Attachments which quickly converted his plain milling machines to vertical mill-

Milwaukee MACHINE

EMERGENCY SERVICE FOR EMERGENCY PRODUCTION PROBLEMS

. . . WHAT TO DO WHEN YOU WANT HELP

The Emergency Production Service Department of Kearney & Trecker Corporation can prove of real value to you when you're on the spot with a production problem. Because they are specialists in milling operations . . . because they know how to get the most in performance — extend the range of application and usefulness of milling machines with standard attachments and accessories, the men in charge of Emergency Production Service are sure they can help you, just as they have helped others faced with production problems.

To avail yourself of their services, all you need do is pick up your telephone and send a wire, stating your problem to the Emergency Production Service Department, Kearney & Trecker Corporation, Milwaukee. Immediately upon receipt of your wire, arrangements will be made to have a trained field representative contact you at once. Depending upon the nature of your problem, he will provide you with complete technical information or call directly at your plant and make his recommendations there.

This service has been established and is maintained for your benefit — to aid you in your war effort. We urge you to use it.

★ ★ ★

ing, as shown above. Naturally, the manufacturer was able to get into production in short order, without delay.

This is but one of many success stories in our files concerning the application of standard attachments and the part they played in solving production and machine shortage problems. Write for full information.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN

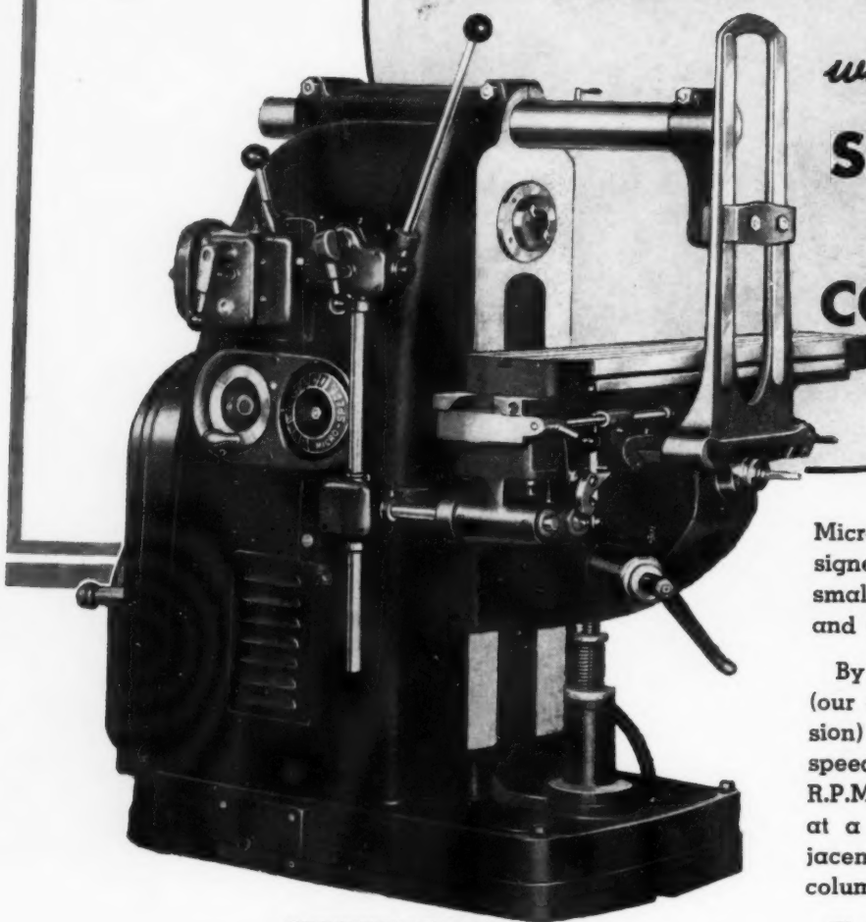
Kearney and Trecker has just completed a new booklet on the "Right and Wrong" of milling practice. You may get your copy FREE by writing to Department C.

KEARNEY & TRECKER
CORPORATION

T O O L S

SIMMONS No. 1 A MILLING MACHINE

with SELECTOR DIAL CONTROL



SIMMONS No. 1-A Micro-Speed Milling Machine, designed for the rapid production of small precision parts, is efficient and simple to operate.

By means of Micro-Speed Drive (our own variable speed transmission) and Selector Dial Control, any speed in its wide range, 56 to 630 R.P.M., may be instantly obtained at a turn of the handwheel adjacent to the selector dial on the column.

Thus the operator is assured the right speed for the job. And that means higher precision . . . faster, more economical production! Write TODAY for descriptive bulletin.

SPECIFICATIONS

SPEEDS: 56-630 R.P.M.
RANGE OF FEEDS: Horizontal, 34"; Cross, 8"; Vertical, 18½".

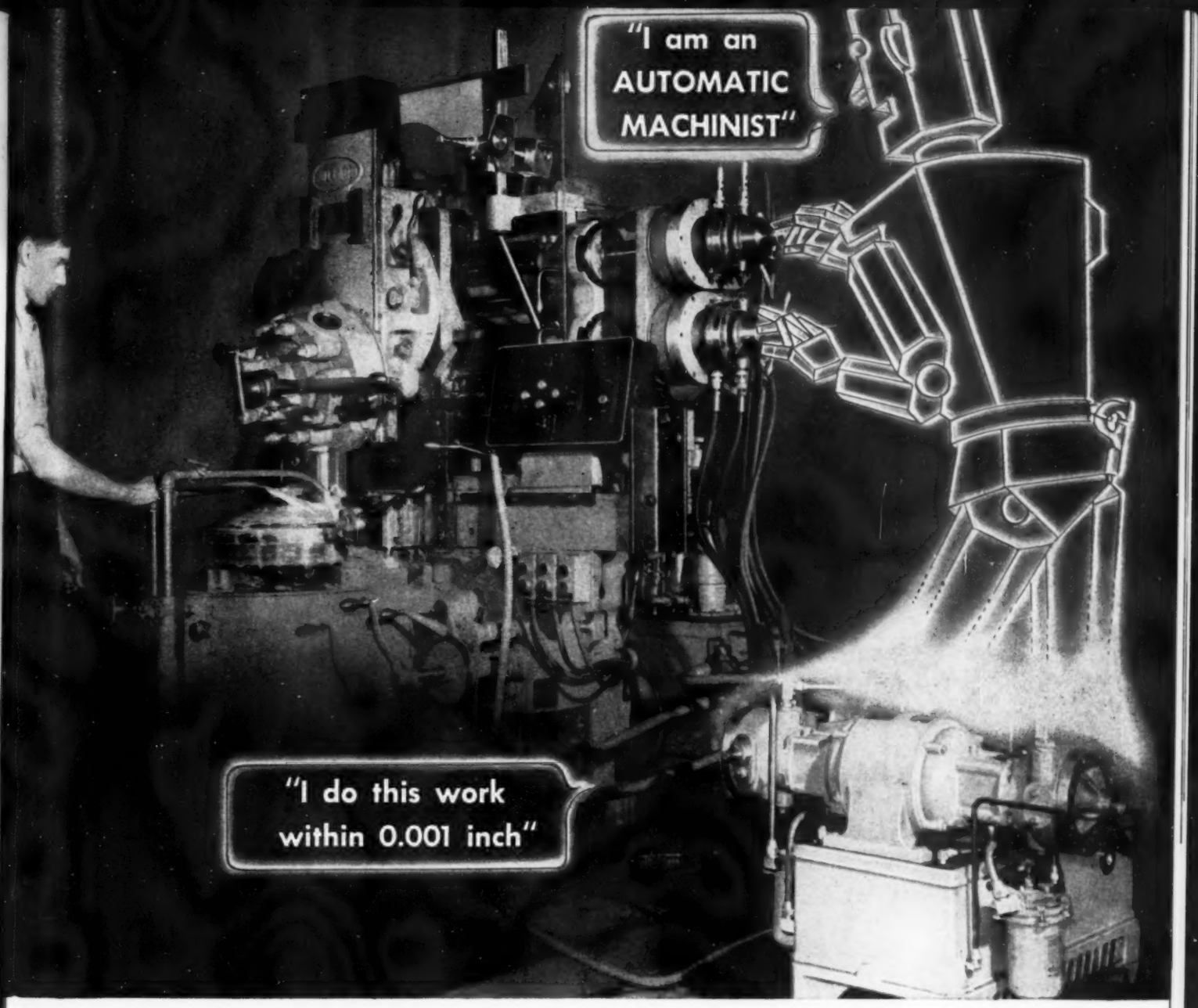
TIMKEN BEARING EQUIPPED

SIMMONS MACHINE TOOL CORPORATION

Main Office: 1759 NORTH BROADWAY, ALBANY, N. Y., *New York Office:* 149 Broadway

SIMMONS

LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES



Get this *AUTOMATIC*, ERROR-PROOF OPERATOR and get 7 TIMES MORE PRODUCTION from your present standard tool room tools.

No human operator could possibly turn the two feeds on this vertical lathe to form-turn this ordnance part at required speeds of production and at the limits demanded. Yet DUPLIMATIC does it, easily, accurately and at speeds that exceed the original specification.

A DUPLIMATIC machine tool control will automatically turn one, or two, or three feed screws simultaneously! It will permit almost any machine tool to be converted over to do contour machining at mass production speeds at accuracies that will astonish you. It is uncannily human, yet it operates with absolute certainty.

DUPLIMATIC "FITS" ANY MACHINE DUPLIMATIC Single, Dual or the three dimensional "Special"—can be quickly connected up with any standard tool room tool. A few hours to connect the drive heads to the feed screws; a few more to show the operator how simple DUPLIMATIC is to handle and mass production at tool room limits has started! An average of 7 times more production than with manual operation alone is the well-established record of DUPLIMATIC.

WHO USES DUPLIMATIC? The biggest producers of war goods use DUPLIMATIC: Pontiac, Cadillac, Chevrolet, Chrysler, DeSoto, Pullman and Pressed Steel Car, A. O. Smith—to mention just a few.

Let us tell you all about DUPLIMATIC. How it can be put into operation in your plant, on your present machines and with your present—or even less skilled—operators.

Send for complete details NOW!

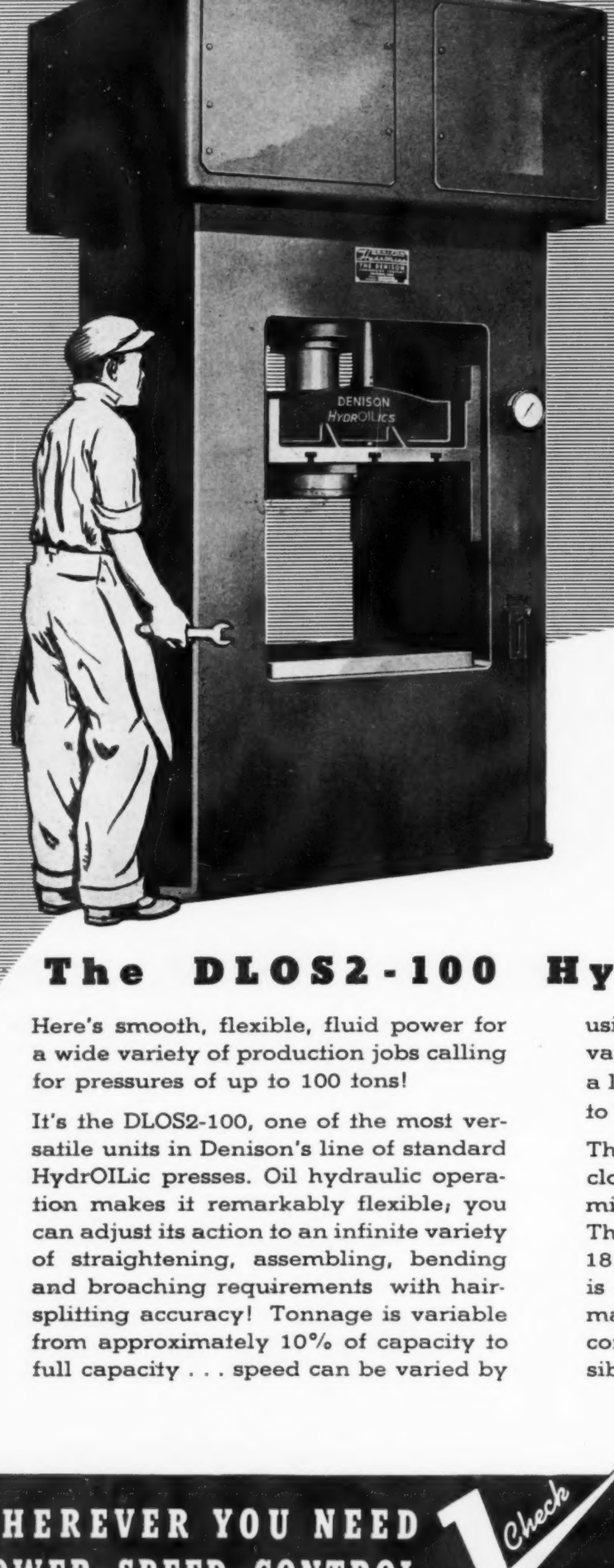
DUPLIMATIC
and your present tool room tools will do more contour machining faster, more accurately and with less skilled help.

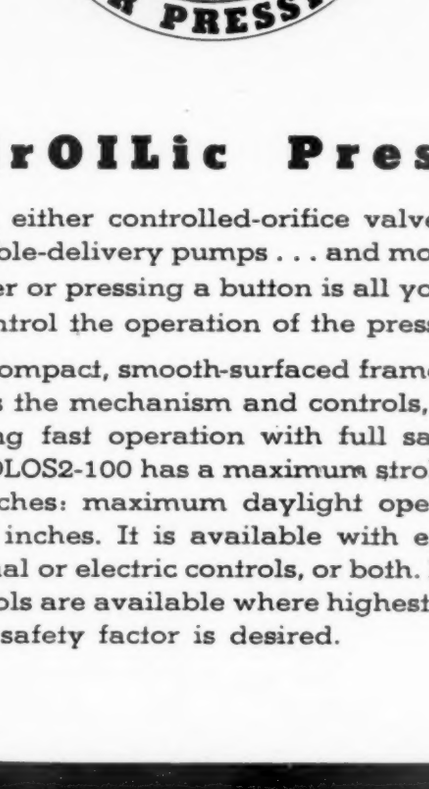
DETROIT UNIVERSAL DUPLICATOR CO.

231 St. Aubin Avenue **Detroit, Michigan**

100 TONS OF VERSATILE HydrOILic POWER

To Meet Your Needs for Fast, Accurate Assembling, Broaching, Bending Or Straightening





The DLOS2-100 HydrOILic Press

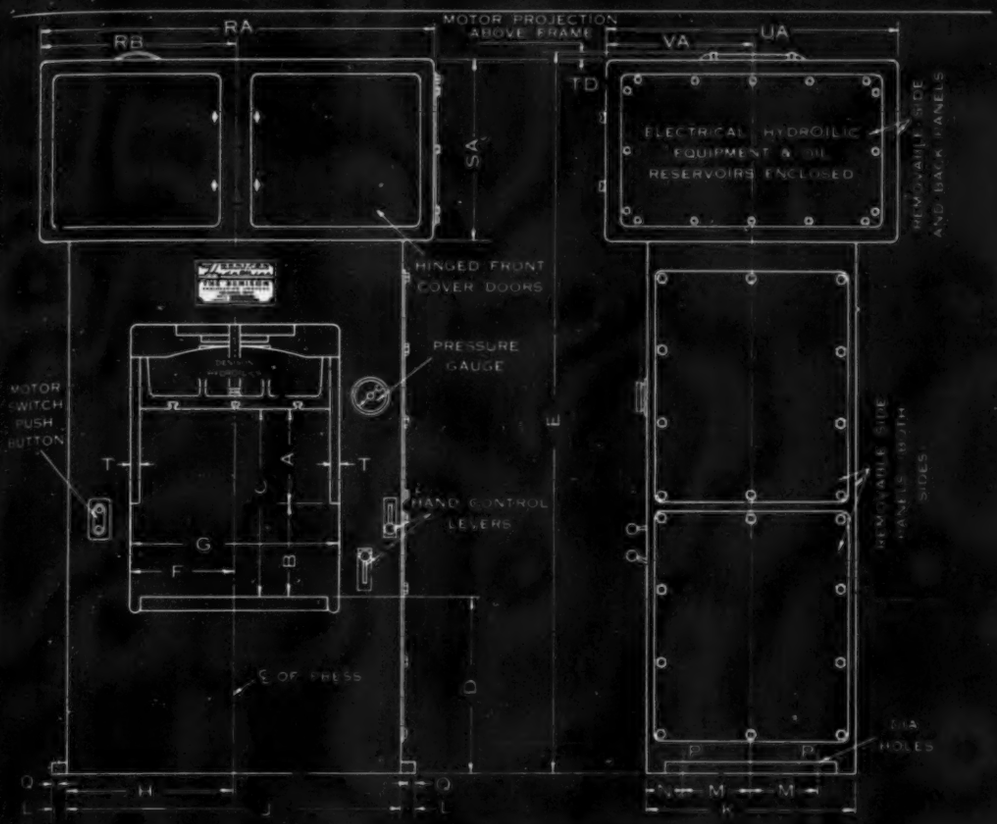
Here's smooth, flexible, fluid power for a wide variety of production jobs calling for pressures of up to 100 tons!

It's the DLOS2-100, one of the most versatile units in Denison's line of standard HydrOILic presses. Oil hydraulic operation makes it remarkably flexible; you can adjust its action to an infinite variety of straightening, assembling, bending and broaching requirements with hair-splitting accuracy! Tonnage is variable from approximately 10% of capacity to full capacity . . . speed can be varied by using either controlled-orifice valves or variable-delivery pumps . . . and moving a lever or pressing a button is all you do to control the operation of the press.

The compact, smooth-surfaced frame encloses the mechanism and controls, permitting fast operation with full safety. The DLOS2-100 has a maximum stroke of 18 inches: maximum daylight opening is 36 inches. It is available with either manual or electric controls, or both. Dual controls are available where highest possible safety factor is desired.

WHEREVER YOU NEED POWER • SPEED • CONTROL

Check DENISON EQUIPMENT in APPLIED HydrOILics



DIMENSIONS	
DLOS 2-100	
A	18
B	18
C	36
D	33½
E	138
F	20
G	40
H	32
J	64
K	40
L	3½
M	13
N	7
P	1⅞
Q	1½
RA	76
RB	38
SA	34¾
TA	2
TB	1⅜
UA	56
VA	28
W	20,000
X	20,100
Y	20,250
Z	750

SPECIFICATIONS	DLOS2
MAXIMUM WORKING CAPACITY, TONS	100
CYLINDER BORE, INCHES	12
RAM SPEED DOWN (HIGH PRESSURE) F.P.M.	1.0
RAM SPEED DOWN (RAPID TRAVERSE) F.P.M.	11.0
RAM SPEED UP F.P.M.	25.0
PUMP VOLUME, GALLONS PER MIN.	60-10-5
MAXIMUM WORKING PRESSURE P.S.I.	2000
MOTOR H.P. 1200 R.P.M.	10.0
RAM DIAMETER, INCHES	9.000
UPPER PLATEN SIZE, INCHES	36 X 36
OIL RESERVOIRS CAPACITY, GALS.	180

OPERATION

When the ram is at the limit of the upstroke, as determined by the upper stroke limit, a shipper rod holds the directional control valve in neutral position, pump and motor idle, and the ram is held in place HydrOILically. Down movement of the control lever causes the ram to move downward at rapid traverse speed, exerting minimum tonnage until it contacts work. Further down movement of the control lever increases tonnage applied to work. If the control lever is released, the ram moves upward until the upper stroke "stop" is reached, moving the control valve to neutral. Minimum HP is used when pump and motor idle.

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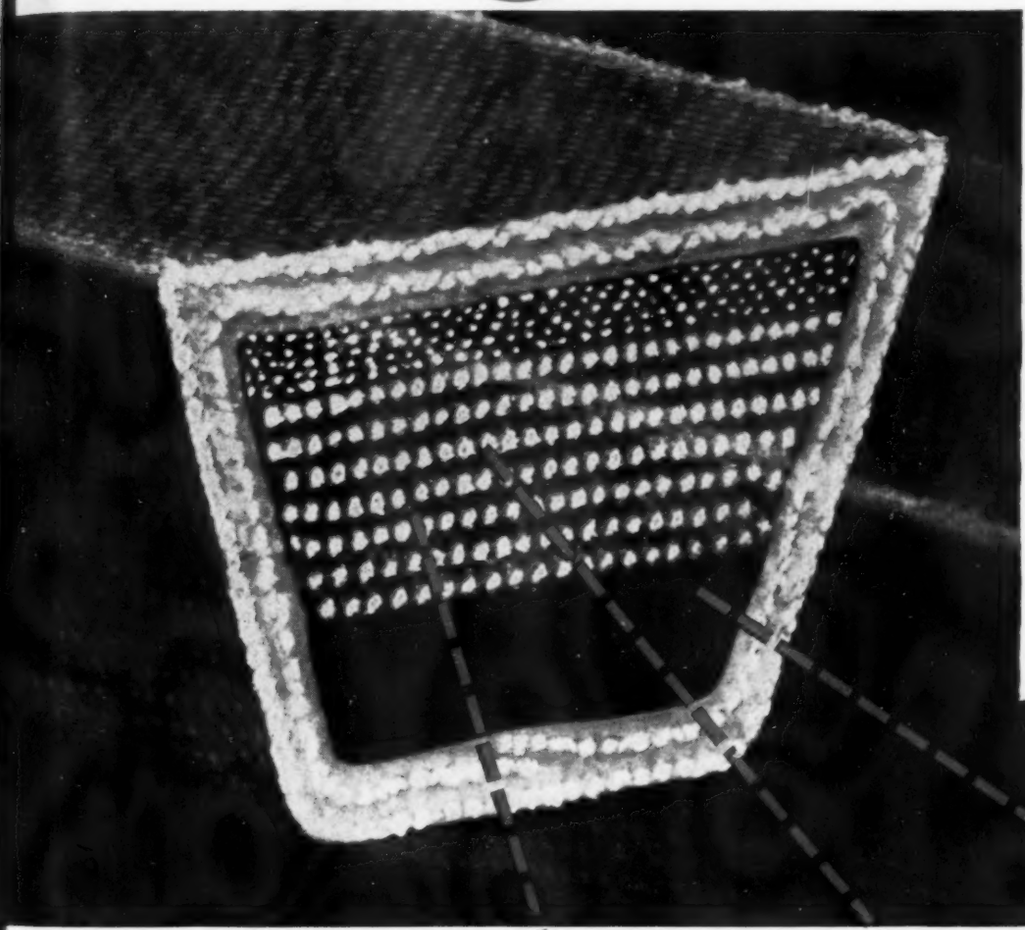

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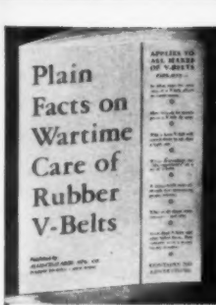

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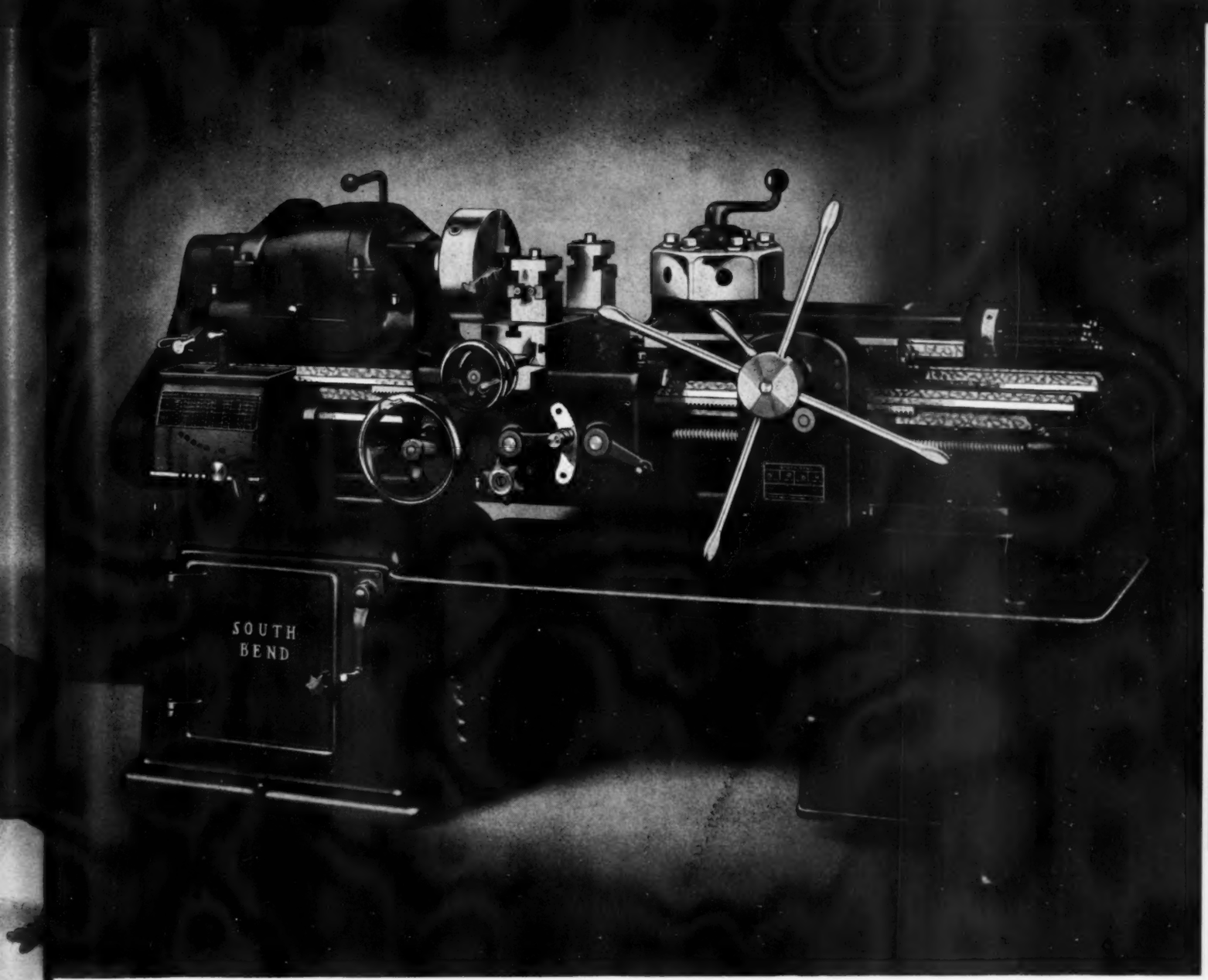

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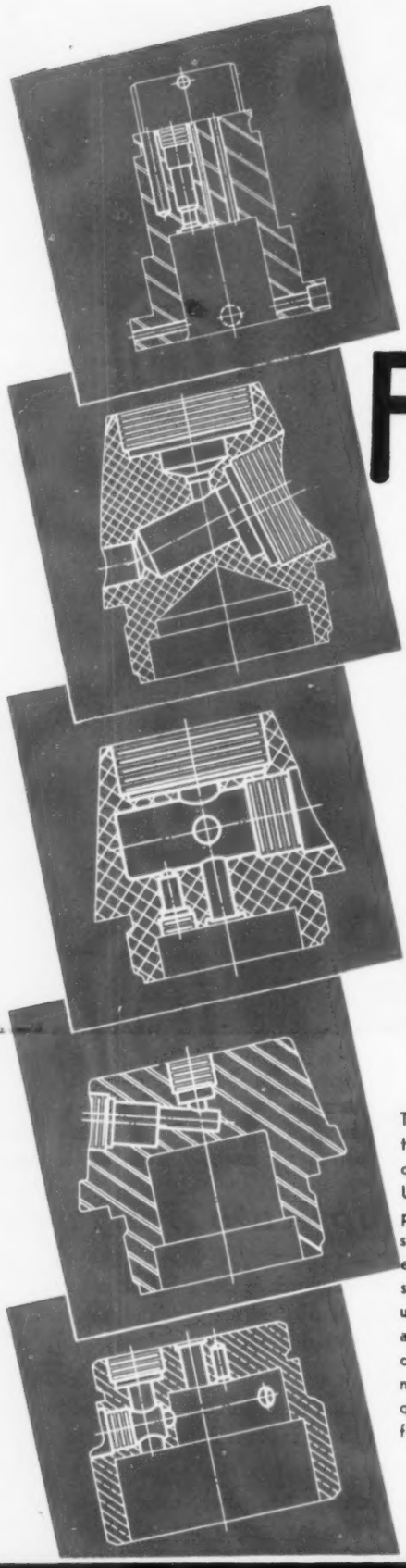

Intricate Fuse Parts Produced with Minimum Number of Chuckings

FLEXIMATIC
by KINGSBURY

The blanks for these shell fuse parts are taken from automatics and completed in from one to four handlings. Kingsbury FLEXIMATICS make it possible to perform in a single chucking a dozen or more highly intricate machining operations on fuse and rifle components and similar parts where speed and accuracy are essential to successful National Defense production.

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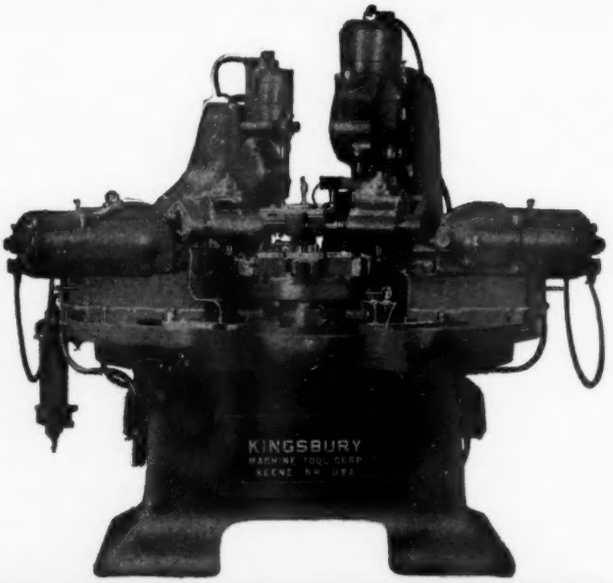
The FLEXIMATIC system of construction consist of Standard Units for drilling, tapping, boring, reaming, spot-facing, etc. Mounted on one of several standard bases. This unique method provides a flexible set-up which can be changed over to meet the machining requirements of many different parts.

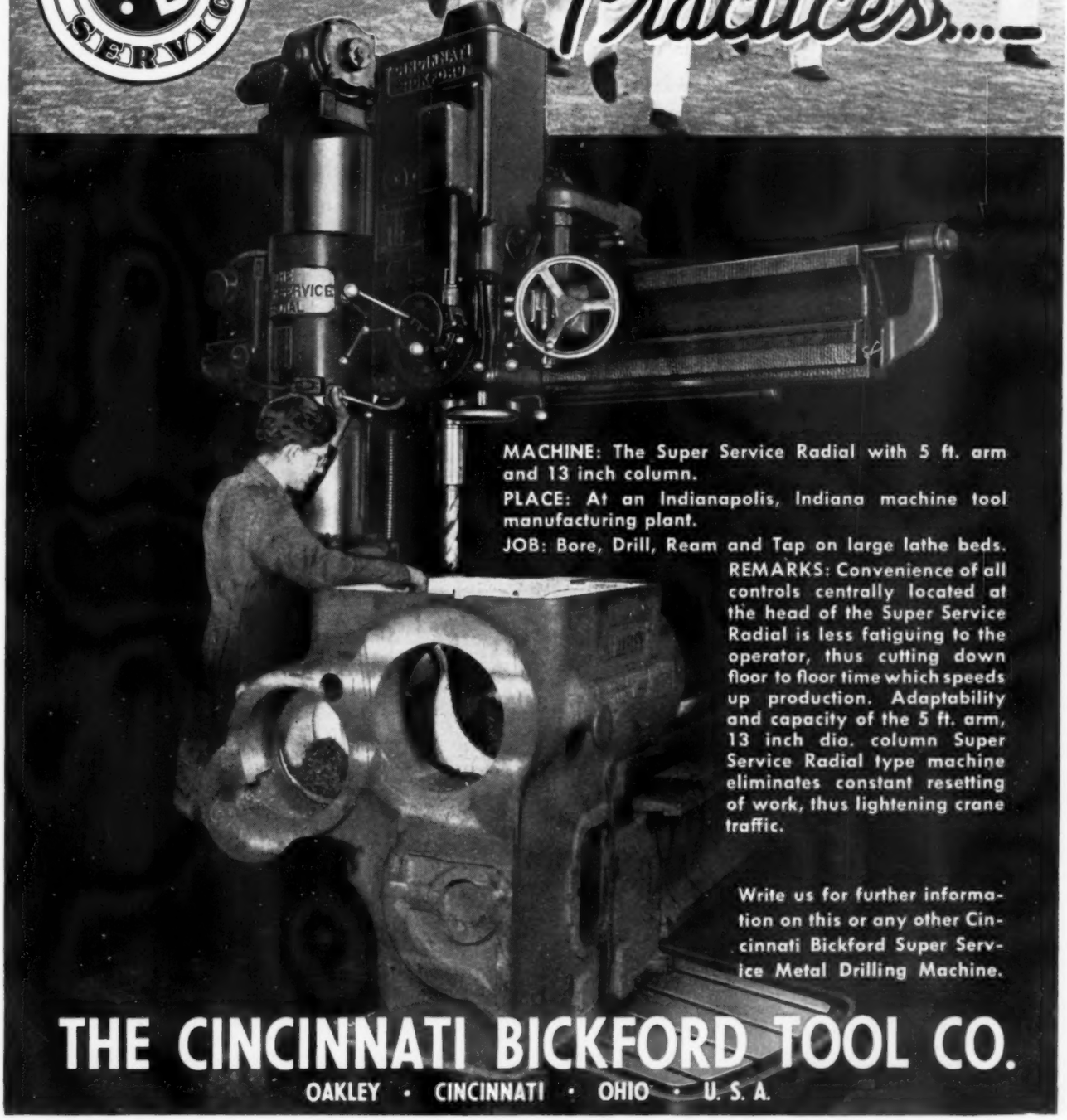


KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U. S. A.

Industrial DRILLING Practices...

SUPER SERVICE



MACHINE: The Super Service Radial with 5 ft. arm and 13 inch column.

PLACE: At an Indianapolis, Indiana machine tool manufacturing plant.

JOB: Bore, Drill, Ream and Tap on large lathe beds.

REMARKS: Convenience of all controls centrally located at the head of the Super Service Radial is less fatiguing to the operator, thus cutting down floor to floor time which speeds up production. Adaptability and capacity of the 5 ft. arm, 13 inch dia. column Super Service Radial type machine eliminates constant resetting of work, thus lightening crane traffic.

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If you were defending your family from a maniac—

—fighting for their lives against a madman who was on the verge of bearing you down . . . as you called on your last ounce of courage and energy, how would you feel if you heard your family behind you laughing and playing, some bickering and greedily quarreling—instead of handing you a club or pitching in to help you fight? . . . Then how must our fighting men feel, as they read their home papers?

If this war is lost (and it is dangerously close to it) don't blame your soldiers and sailors—blame yourself. Not the man or woman in the next block or at the next machine or desk, but *yourself.* All wars are lost by the people back home who want somebody else to do the fighting, the dying, the sacrificing for them.

The fifth column that is sapping America's effort—sapping it perilously close to defeat—is less secret Axis sabotage than selfish American indifference. Read it any day in your paper . . . search for it every second in your heart—

—Lack of rubber may ground American planes—yet rubber is wasted by the ton on Sunday driving, trips to movies, card parties, anywhere to save a little energetic walking.

—Decisions vital to war must wait while politicians (not, thank God, the patriots among them) mend fences instead of mending holes in our country's armor.

—Pressure groups shout for curbs on inflation while pushing their own greedy demands that will cause inflation.

—The racetracks, bars and ballparks are packed with men and women "getting a little relief" from war work—"relief" that will mean fewer guns, planes and shells where and when they're needed. (We're very careful of our own "morale" . . . what about the morale of men in Australia, Libya, on the deadly seas?)

The list can go on and on. You know it. Each knows in which he's guilty. If you think you can keep your social gains, your profits, your ease, your comfort—if you think this can be somebody else's war, you're right—it will be Hitler's war. Isn't it better to face *your* responsibility *now* than to face a Hun-Jap firing squad next year?

WHAT'S IN THIS ISSUE

TESTS FOR SHOP TALENT

The Lycoming Division, the Aviation Corporation, has devised a series of tests to show the capabilities of its new operators. These tests are given after an employee has been on the job a few weeks and may be done at home if the operator wishes. Their purpose is to appraise each man's knowledge of his job so he can be given a higher degree of responsibility. Page 1165.

P. W. BROWN

PRECISION THREADS

If anyone has an idea that precision threads cannot be cut on a manufacturing basis it is being disproved right now. P. W. Brown, assistant works manager, Wright Aeronautical Corporation, is turning out plenty of Class 3 and 4 threads, both by die cutting and by rolling. The secret is proper maintenance of machines and tools. Page 1151.

GEAR GENERATION

Part II of the series on "Gears and Gear Cutting" stresses the special advantages of the generating process. The system simplifies the amount of tooling required and lends itself also to modifications of the tooth profile that are often advantageous. A. H. Candee, the Gleason Works, reviews the art in this issue. Page 1162.

DRAFT ANGLES

Dies and molds of many kinds have draft angles to clear the workpiece after it has been formed. It is often valuable to know just what these angles mean in thousandths of an inch for various depths. The answer is to be found in a pair of carefully compiled tables by W. J. & P. T. Woodworth. See the Reference Book Sheets in this issue. Pages 1189 and 1191.

HEAT BY INDUCTION

The second and concluding article on induction heating by Rupert LeGrand points out the wide variety of uses to which this process is applied. Localized heating effectively reduces distortion on both internal and external surfaces. Forging, soldering and brazing can also be done this way. Page 1158.

BUCKING MOUSE

Because of the ingenuity of William Holcomb, assistant superintendent, Lockheed Aircraft is now using a new type of bucking bar or "mouse." This device has proved invaluable in riveting inaccessible parts of an assembly. The mouse is just one of a two-page spread of ingenious shop ideas. Page 1168.

TOOLING FOR THUNDERBOLTS

Republic Aircraft's high altitude, high speed fighting ship, the *Thunderbolt,* is built on jigs of welded construction. The tubular frames for the jigs are erected from perspective sketches. Locating points are added later from drawings of the ship itself by experienced toolmakers. The entire process, including a description of how these jigs are used, is told by O. G. Pyler, Republic tool engineer. Page 1173.

O. G. PYLER

E. S. GALLAGHER

NEW THICKNESS GAGES

Film thickness of painted or plated parts may be measured electrically by new gages described by E. S. Gallagher, special products section, General Electric Company. One type of gage is employed on magnetic materials, another on non-magnetic materials. An additional application is the determination of web thickness in nonferrous parts where it is impractical to employ mechanical measurements. Page 1155.

COMING

In the new plant operated for the United States Navy at Canton, Ohio, Westinghouse was forced to train 80 percent of its workers who had no previous industrial experience. The process was made as direct as possible by putting prospective operators in the training school on the same type of job to which they were assigned in production. Tools and jigs are arranged to obtain precision results from these inexperienced workers. An article describing this remarkable training system will appear in an early number.

Finishing operations take plenty of space especially when time is needed for drying. Fleetwings, Inc., has used its overhead area for carrying parts through its finishing departments, thus solving material handling and drying problems simultaneously. The conveyor system used for the purpose will soon be described by Frank M. Bates, the company's chief engineer.

Continental Motor Company's ingenious use of old machine tools in the manufacture of tank engines forms an interesting conversion story. Look for it soon.

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CINCINNATI, OHIO

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Close-Tolerance Screw Threads

BY P. W. BROWN, ASSISTANT WORKS MANAGER, WRIGHT AERONAUTICAL CORPORATION

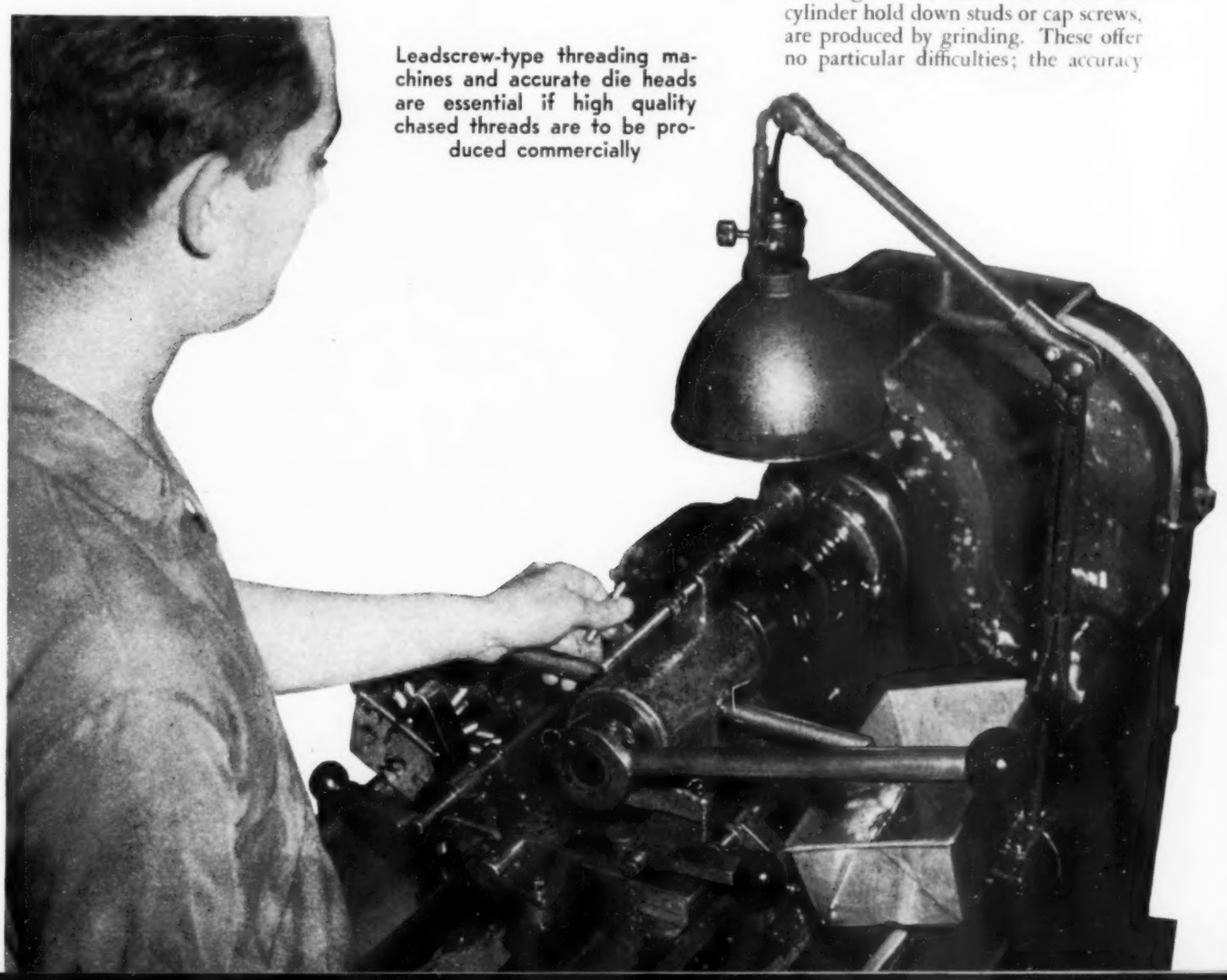
Skilled operators using first-class tools and equipment can produce die-cut screw threads to close tolerances when all variable factors are controlled

THE NATIONWIDE ADOPTION of a program of subcontracting has proven to be essential to the prosecution of our war production campaign and that it has been so completely successful reflects to the credit of American industry. It has not been an easy task, and there have been many seemingly insuperable obstacles to be overcome.

One of the worst of these difficulties, and one which is still causing a great deal of trouble, is the production of screw threads to Class 3 tolerance in large quantities with the necessary high-grade finish. That this can be done, and done at high speed and reasonable cost, has been demonstrated by the Wright Aeronautical Corporation, which is regularly manufacturing studs in hundred thousand piece lots, besides scores of other threaded parts in huge quantities, to Class 3 and even Class 4 tolerances. The methods by which these close tolerance thread are manufactured were not developed overnight, but rather have come about through a long program of research.

There has been, not unnaturally, considerable speculation as to whether such tolerances are necessary in every case in which they are specified, but this is a matter of design engineering and outside the scope of this article. Suffice it to say that if such tolerances are called for on the prints, it is the job of the production engineer to produce them.

Certain threads, particularly those in the larger sizes and those used for cylinder hold down studs or cap screws, are produced by grinding. These offer no particular difficulties; the accuracy



Leadscrew-type threading machines and accurate die heads are essential if high quality chased threads are to be produced commercially

is built into the machine, which is equipped with an automatic wheel dressing device and a precision ground leadscrew. If the thread grinder is kept in good condition and reasonable care is taken, Class 3 and Class 4 threads can be produced by any ordinary, properly trained operator.

Skill Necessary When Using Dies

The production of die-cut threads, however, is an entirely different matter. It demands a combination of operator skill and experience, first-class equipment, close inspection, and careful supervision. The machines, whether automatic or hand operated, must be checked frequently and carefully to be certain that there is absolute alignment between the work piece and the diehead.

Misalignment is one of the most common causes of trouble, and not only produces taper threads outside of limits, but is also a major reason for chaser breakage. The starting of the chasers on the work is also extremely important. If the machine is hand operated, the start should be vigorous and positive. On an automatic machine, the cam must be properly laid out, and it is frequently advisable to stone it carefully at the start of the cam rise.

The accuracy of the chasers themselves is of the utmost importance. These should always be purchased with a guaranteed lead error not to exceed plus 0.0000, minus 0.0005 in. in one inch. Such chasers are available on the commercial market. An examination of a worn chaser will reveal the necessity for the minus limit. As a chaser wears and becomes dull the lead increases, so that if it starts out with a minus tolerance there is room for considerable wear before the error becomes positive.

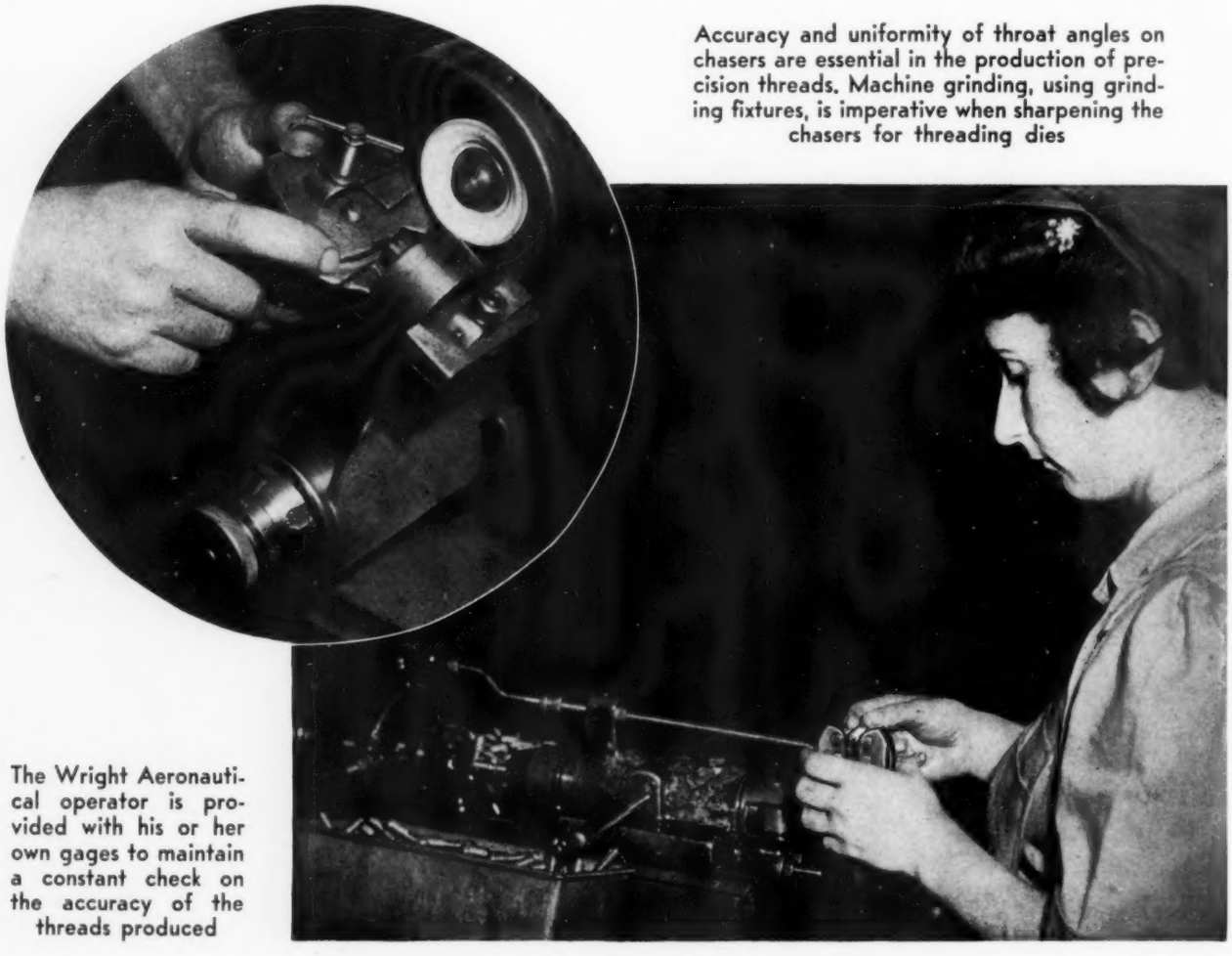
The practice at the Wright Aeronautical Corporation has been to determine by actual test the number of pieces that can be obtained per grind for each size and pitch while still retaining the necessary accuracy and finish, and then to change chasers almost automatically when, or slightly before, this number of pieces has been made. Furthermore, the hardness of the chasers should be checked, and should be specified within a close range. This will vary somewhat with the different tool steels, but on the average should run about Rockwell C 60-63 hardness.

The importance of proper chaser grinding cannot be over emphasized. Optimum angles must be established for each different material, since it cannot be expected that a chaser ground for one type of material will give satisfactory results on another type.

The chamfer on the throat should be as long as possible to permit starting of the threads on the part without shaving, and this angle must be uniform on each chaser of a set. In this regard, the use of grinding fixtures is imperative. The clearance angle at the throat is likewise highly important, and should be as small as possible in order to permit a burnishing action, and produce a smooth, accurate thread, free from slivers and scores.

Check Diehead Frequently

The diehead itself must be kept in first-class condition, with frequent cleanings and inspections to see that there is no more play in any of the moving parts than is necessary for smooth operation. This involves higher replacement costs, but is essential if accurate results are to be obtained. Play in the diehead, like play in the



Accuracy and uniformity of throat angles on chasers are essential in the production of precision threads. Machine grinding, using grinding fixtures, is imperative when sharpening the chasers for threading dies

The Wright Aeronautical operator is provided with his or her own gages to maintain a constant check on the accuracy of the threads produced

machine spindle, can easily absorb the entire tolerance permitted on a Class 3 or Class 4 thread.

It is, of course, impossible to produce accurate threads if the stock itself does not run true. For this reason the outside diameter should be turned, or preferably ground, to size. Grinding serves to remove any slight surface decarburization and thus does away with the tendency of the material to tear and form heavy burrs. Experience at Wright Aeronautical has shown that the best results are obtained by holding the outside diameter from the mean to the low limit, with the low limit preferred. The concentricity of the chamfer with the outside diameter should also be carefully watched in order to assure the chasers starting true. The hardness of the material must likewise be strictly controlled, and should not vary more than four, or at the outside six, points (Rockwell C scale) for any one type.

Cutting Speed Important

Of all the various factors which must be considered for the successful production of close tolerance threads, none is more important than that of cutting speed. This will vary, naturally, with the different materials used, but it is safe to say that as a general rule this should not exceed 10 percent of the average speed used for turning. This may appear to be excessively slow, particularly in view of the tremendous demands now being made in war industries, but experience has shown that these low speeds result in the production of a greater number of good pieces per day than can be obtained when using higher speeds with a greater percentage of scrap work. Cutting oil also plays an important part, and at Wright Aeronautical a sulphur chlorinated oil has given best results. This, however, must be properly diluted with paraffine oil to suit the hardness of the material, since improper dilution may spell the difference between success and failure.

Considerable thought should be given to the design of the part itself. Every effort should be made to avoid narrow undercuts and threading extremely close to shoulders, so as to obviate the necessity of using short throat angles. Where possible, the undercut should blend into the thread diameter with a 45-deg. angle, rather than the 30-deg. angle commonly used. This will reduce the burr, give a better blend between the thread and the undercut, and permit a longer chamfer on the chasers. Great care should also be taken in handling the finished parts; these should, under no circumstances, be dropped into tote boxes with hundreds of others. Perforated carrying boards offer one of the best and safest methods of handling the finished parts.

Threaded parts should be placed in perforated boards so they will not strike against each other with possible damage to the finished threads

In so far as inspection is concerned, it is impractical to make use of thread ring gages for close tolerance work. Thread roll snap gages, however, will give satisfactory results provided these and the set plug are specified to "W" tolerance, and a periodical comparative check is made of all the gages and set plugs. The constant use of a magnifying glass will assist the operator in judging the proper time for regrinding the chasers. A skilled man can tell by the condition of the finished thread when this moment has arrived.

When extreme accuracy of lead is needed, as on the "drive end" of studs, leadscrew stud threaders furnish the answer.

Where threaded parts are to be cadmium plated, as is frequently the case with those required for ordnance work, it is permissible to make the pitch diameter 0.001 in. under the drawing limits before plating, provided that it lies within the limits after plating. This rule does not apply to the drive end of studs which may not be cut undersize, but may be as much as 0.001 in. oversize after plating. This is occasioned by the fact that the plating tends to act as a lubricant, and is partly or entirely removed during driving. A depth of plate of between 0.0002 and 0.0004 in. is adequate to meet government requirements for corrosion resistance, but as this will increase the pitch diameter by from 0.0008 to 0.0016 in. it is advisable to hold as closely as possible to the low limit. This is readily done by controlling the length of time in the plating tank.

American standards call for the same basic diameter on both screw and nut threads, with the result that it is possible to obtain a size to fit which considerably hampers assembly. For some time it has been the practice at Wright Aeronautical to introduce a neutral zone by reducing the basic pitch diameter of the external thread without, however, reducing its minimum. This, of course, reduces the amount of tol-

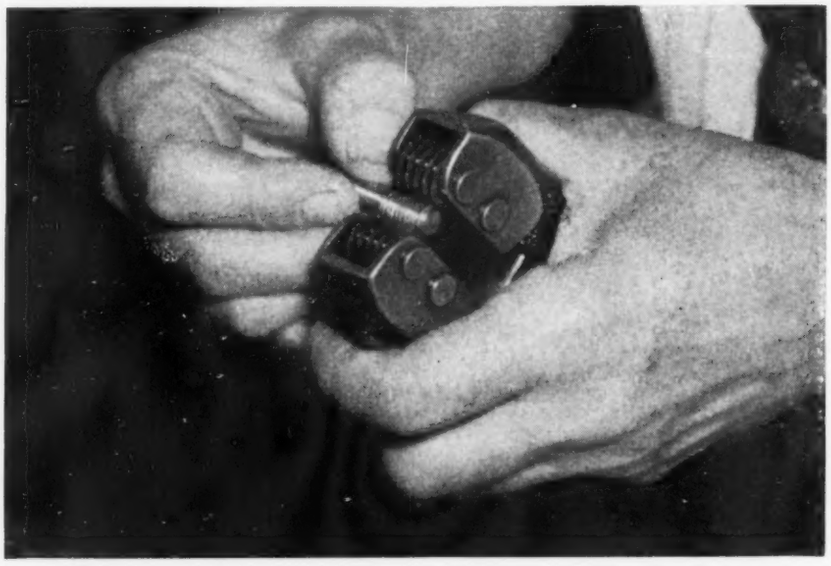
erance available for manufacture, but greatly simplifies the assembly process. The neutral zone amounts to 0.0005 in. on sizes up to 1¼ in. diameter, and increases up to 0.002 in. for the larger sizes.

The production of tapped threads should present few difficulties, provided the proper tap is used, and it is kept sharp and in good condition. For tapping magnesium and aluminum alloys the best results are usually obtained with a two-flute tap on sizes under ¼ in., and with a three-flute tap on sizes over ¼ in. On steel parts a four-flute tap seems to give the best results on all sizes over ¼ in. In most cases the holes should be reamed to size before tapping in order to obtain greater uniformity, longer tap life, less burrs on the crests and better finish. Probably as a result of the burnishing action of the reamer, it is usually found that there is much less tendency of the threads to tear in a reamed hole than is the case when the hole is merely drilled. The general practice at Wright Aeronautical is to specify the basic hole size with a limit of plus 0.005 in., minus 0.002 in., and to hold to 0.002 in. under the high limit, except on automatic screw machines where a plus or minus 0.001 in. limit is used without production sacrifices.

Although excellent results can be obtained with a standard tapping attachment, the use of a leadscrew is generally found most desirable for the prevention of lead error, since it eliminates the drag which must be present when the tap does its own driving. Whether or not a leadscrew is used, however, there should never be any difficulty in tapping to within a total tolerance of 0.001 in., and in most cases the size can be held within plus or minus 0.0003 in. of the pitch diameter of the tap. On non-ferrous materials this accuracy can be obtained with a single tapping, but on steel, and particularly the tough steels used in aircraft engine work, it is advisable to make use of a combination roughing and finishing tap having approximately four threads on the roughing portion.

A comparatively new development at the Wright plants is the production of rolled threads on studs. The material has a hardness of Rockwell C 26 to 32, and the blanks are ground to a total tolerance of 0.0005 in. before rolling. On these parts, Class 4 threads are consistently held to within 0.0003 in. circularity.

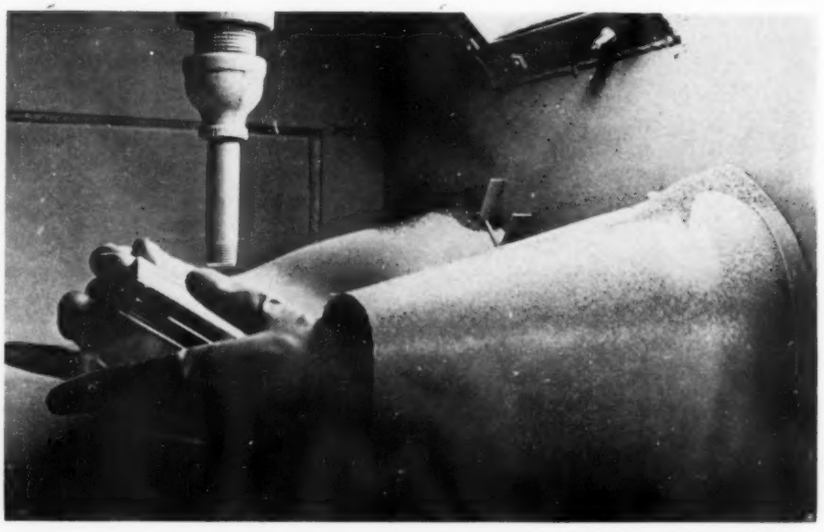
By the observance of due care, and by placing quality always ahead of quantity, there is no reason whatever why any manufacturer cannot produce Class 3 and Class 4 threads, provided, however, that there is a clear understanding that such threads are precision parts and cannot be made by hit and miss methods on worn-out equipment operated by totally unskilled labor.



After each set-up, a Wright Aeronautical floor inspector checks the first piece made before permitting production to continue. Thread roll snap gages give satisfactory results

Synthetic Resin Replaces Rubber in Industry

A flexible, resilient synthetic resin known as Resistoflex PVA has been developed by the RCA Manufacturing Company and is now being used as a substitute for rubber in a number of applications. Illustrated is a sheet Resistoflex shield which protects the operator's wrists in a sandblast machine for cleaning small parts. The Resistoflex resistance to abrasion and wear has made the new shield far outlast its rubber predecessors. The synthetic resin is resistant to the many solvents that attack rubber when it is used in metal-cleaning processes. A hose assembly placed on a machine a year ago is said to show signs of depreciation, whereas the life of rubber hose was only a few months on the same machine. Other applications are to be expected.



Quick Methods for Measuring Thickness

Fig. 1—The thickness of plating over steel parts can be measured by this gage in a few seconds without destroying the plating on the part tested

BY E. S. GALLAGHER, SPECIAL PRODUCTS SECTION, GENERAL ELECTRIC COMPANY

With these gages the thickness of the plating can be quickly checked on every part as it moves into the production line

CONTROL over the thickness of painted, enameled, or plated steel parts on the production line becomes more important as higher production schedules are set for producing war goods. Likewise, many metals, such as chromium, nickel and tin are restricted and must be used as economically as possible.

Therefore, a means of checking such films rapidly, accurately and without marring the finish or destroying the surface, is highly desirable. Accuracy of measurement assures that the quality standard of the product being produced is maintained, but finding ways to reduce losses and scrap on parts is equally important.

Parts manufactured from such metals as copper, brass, bronze, aluminum, and aluminum alloys require new methods of measuring wall thicknesses with speed and accuracy. Gages for such measurements have been developed in recent months and are now being used to solve many problems.

One such solution has been made in the manufacture of aircraft, truck, and tank engines. In this particular application, the thickness to be measured was that of the lining of the crankshaft and connecting rod bearings. The linings used in these types of bearings are either lead-bronze, copper, silver, or heavy babbitt; their thickness range is from 0.005 in. to about 0.050 in. The bearing linings are checked in the final stages of finishing the complete bearing, and the measurement must be made accurately without marring or scratching the finished surface. Because the film thickness gage shown in Fig. 1 not only meets these requirements, but also is speedy in operation, it is being used extensively.

Some steel parts are heavily chrome, nickel, or cadmium plated to increase the wearing qualities or to prevent corrosion. However, since the beginning of the war the use of these metals has been restricted to essential parts, making it necessary to check the thickness of the plated parts to be sure that a minimum but adequate thickness of these metals has been deposited.

The thickness of plated steel parts has usually been checked by removing a portion of the plating from parts taken at random from the production line. Then the bare portion has been carefully measured by means of a micrometer and compared with a meas-

urement taken over the plated portion. The difference in the two readings of the micrometer was the measurement of the plating.

The gage shown in Fig. 1 also is used for measuring the thickness of electroplating on steel without destroying the plated surface. Because of its speed of operation, the uniformity of the plating for each part can be checked.

Used in Carburizing

Camshaft gears, accessory-drive gears, and timing gears on aircraft engines have carburized or nitrided teeth and hub sections. Before the gears are carburized or nitrided, the sections which are not to be treated are plated with a thin coating of copper or tin whose thickness is approximately 0.001 in. The copper plating prevents carburizing while the tin plate prevents nitriding.

Should the sections which are not to be hardened have thin spots in the copper or tin plate, a certain amount of hardening will take place and the gear must then be scrapped. It is highly desirable, therefore, to check the thickness of the plated sections before the gears which have been plated are heat-treated. Such a measurement should be made easily and accurately, should be non-destructive, and also should be made quickly so as not to hold up production. For this job, a small-size gage head was designed so that gears as small as 2 in. in diameter and with a web of less than $\frac{1}{2}$ in. in height could be readily checked.

Many of the aluminum and magnesium castings being turned out in today's war effort are quite complicated in that they may contain a great number of separate cored sections, not accessible to the usual type of micrometer. In fact, the writer recently saw one of these castings which had 57 separate cored sections, many of which had shifted thus causing thin wall sections.

Fig. 2—The thickness of castings of non-magnetic metals, such as copper, brass, bronze and aluminum alloy, can be measured with this gage

The problem has been to check the soundness of the different cored passages to locate thin sections or flaws before expensive machine work is done. Heretofore, this has been done by taking one of a lot of castings and sawing it into various parts so that the exposed sections could be checked. Obviously this is not satisfactory since in addition to destroying the casting, the casting destroyed might be sound while others in the lot passed as "sound" might contain flaws apparent only after machining, or after failure in operation.

An outgrowth of the film thickness gage was the model shown in Fig. 2 particularly designed for this casting job. With it, the thickness of non-magnetic metal shapes of magnesium, aluminum, and aluminum alloys can now be measured quickly and accurately on a production-line basis. Measurement need be made from only one side.

A manufacturer of transparent sheet plastics wanted to measure the thick-

Fig. 3—Checking for thin sections in large plastic sheets is possible with this gage. The measurement can be made over the entire area of the sheet

ness of these plastics, checking for thin sections in the sheets before fabrication, the measurements to be made over the entire area of large sheets ranging in thickness from 0.004 in. to 0.75 in. It was highly desirable to have one gage which could be used over this entire range. Portability along with accuracy were necessary. Furthermore, it was necessary that the gage be simple to operate so that anyone could operate it without special instructions as to its use. A special thickness gage was designed to meet this manufacturer's requirements. Actually, this gage is nothing but a grown-up edition of the film thickness gage shown in Fig. 1.

Recently a bearing manufacturer wanted to determine the depth of the casehardening on bearing raceways without destroying the highly polished raceway surface. The more usual means of determining the depth of casehardening is by means of a Brinell or Rockwell hardness tester, or by cutting through the raceway, etching the exposed metal, and then making a photomicrograph of the grain structure. In this manner, the depth of casehardening can be readily determined. However, this method in addition to destroying the bearing raceway allows only a random check of production bearing raceways.

Casehardened Depth Checked

A film thickness gage, similar to that shown in Fig. 1, is now being used satisfactorily on a production basis to measure the depth of the casehardening of each bearing without destroying its surface. The scale of the gage now being used is marked in arbitrary figures rather than in direct terms of thickness so that the manufacturer can correlate the indication of the gage with the depth of casehardening, as determined by other means, and thus prepare a family of curves for each grade of steel being used in the manufacture of the bearing raceways.

These gages help industry lick the problem of measuring thickness on a production-line basis without seriously interrupting the flow of war goods. Peacetime uses of the gage in Fig. 1 for checking the thickness of paint films on automobile bodies, porcelain enamel films on refrigerators, ranges, and various enamel-ware products and the suitability of this gage for film thickness measurements on curved or flat steel or iron surfaces, may indicate similar applications to war products.

Unbalanced Reactances Do It

The gages are usually accurate to plus or minus 5 percent, and only one or two seconds are needed for each measurement.

All of the gages which have been used in these various applications operate on the well-known principle of a reactance-type bridge circuit. In its simplest form this circuit is a means of measuring small amounts of unbalance in the reactance of two coils of wire.

Fig. 4 is a simple schematic diagram of the reactance bridge circuit. Connection *A* is for a 115 volt, 60 cycle power supply which is normally used, although other voltages and frequencies have been used. *B* is an iron core reactance contained in the gage head while *C* is the companion balancing reactance. *D* is a differential transformer and *E* is a rectifier bridge used to convert the alternating current component to direct current for measurement by instrument *I*. If the gage head containing reactance *B* is placed, for example, on a bare piece of steel a magnetic field will be set up as in Fig. 5.

By means of adjustments contained in the thickness gage circuits, the values of coil reactance for *B* and *C* can be balanced so that instrument *I* reads zero.

Now if a similar piece of steel is substituted on which a coating of paint, enamel, or plating has been deposited, the thickness of this coating is the same as introducing an air gap in the magnetic circuit illustrated by Fig. 5. Such an air gap changes the magnetic circuit and, correspondingly, the coil reactance of *B*. With the reactances of *B* and *C* unbalanced circulating currents flow which are measured by instrument *I*.

The scale marking of instrument *I* can be in arbitrary figures, thus allowing each user to make the most satisfactory calibration or, more commonly, the scale can be marked in decimals of an inch.

Of course the gages described use variations of the electrical bridge circuit, some forms more complex than others but all employing the same basic principle.

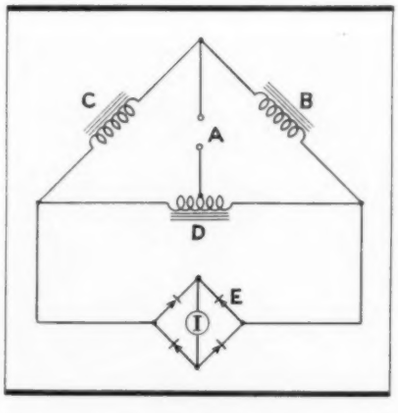


Fig. 4—A schematic diagram of the reactance bridge circuit used in various types of thickness gages

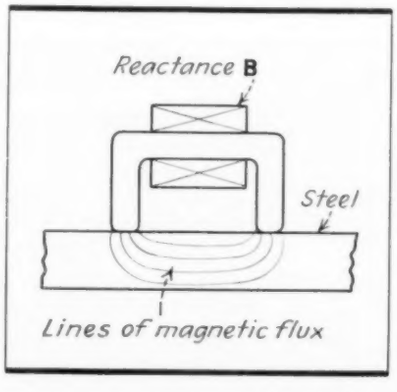


Fig. 5—Any coating on the steel surface has the same effect as an air gap on the lines of magnetic force and changes the reactance of *B*

Suggestion for Suggestions

BY W. O. DOWNS

The practice of encouraging suggestions by employees has been used by large industrial concerns for many years. While many of the suggestions so submitted are adaptable only to the concerns in which they originate, some would apply equally well to other concerns regardless of the nature of the product manufactured. An interchange of suggestions of a general nature would work out to the betterment of all concerned.

Suppose a concern had, say, 100 suggestions to offer and exchanged them for 100 from another concern; this would mean that both concerns would have 200 such suggestions. While it is true that a number might overlap, it is likely that each concern would profit by ideas from the other.

To carry the line of thought further, if ten concerns installed a suggestion pool, each of them would exchange its original hundred with nine others and obtain in exchange for 100 suggestions, a total of 900 items. While the number of 100 is used as a basis of illustration, 10, 15, 25, or 50 suggestions might be considered to start the program in case the larger number was not available.

Particularly today when war production plants are so anxious to get suggestions from their employees for speeding production, a pool of suggestions should be useful.

New Uses of Induction Heating

BY RUPERT LEGRAND, DETROIT EDITOR, AMERICAN MACHINIST

Part II of this article describes how induction heating has been applied to a wide variety of both external and internal work

LOW CARBON STEELS with a carburized case, plain carbon steels and alloy steels of medium and high carbon content and alloy cast irons can be hardened. The higher the temperature required for metallurgical transformation, the more difficult it is to control depth of hardness because of the longer heating time involved. Yet, high-speed steels can be induction hardened, which opens up a new technique for achieving maximum hardness at the cutting edge while retaining a tough core. High-carbon steel punches for drawing cartridge cases are being hardened by the method to minimize distortion and grinding allowance. Oil hardening steels can be hardened with water because of the close control possible over the pressure and time of water quenching.

Surface Hardness Higher

The structure of induction hardened material is characterized by a homeogeneous nodular martensite with gradual transition through the pearlitic martensitic demarcation area to the pearlitic structure of the core. Surface hardness, usually a few points higher than obtained with other methods, is maintained for approximately 80 percent of the depth heated, Fig. 8, and gradually decreases from that point to the original core hardness. The bond is such as to eliminate chance of spalling or cracking.

Several examples of selective hardening of steels are shown on Fig. 9. If required it is possible to harden a piece of steel and braze copper or other metals to the steel article in the same operation.

The hardening of internal work—the bores of steel tubes, rings, aircraft-engine cylinder barrels, alloy-iron diesel engine sleeves, the bearing races in wheel hubs for automobiles and trucks—is a distinct application of induction heating. The energy that can be applied to the inductor, or heat head, is of high order—up to 200,000 amp. per sq.in. of copper, because the coil can be wound on an iron core. Hence the heating time is in the order of split seconds, instead of seconds as with external work.

This circumstance compelled development of equipment that has the appearance of a machine tool (ordinarily of an upright drill) in which all movements are under precise and coordinated control. Power is supplied to the heat-treating machine by a lead-sheathed cable running to a 3,000- or 9,600-cycle generator. A massive conducting arbor, similar to a machine tool spindle, connects the heat head to the special transformer located at the top of the machine.

A suitable work-holding fixture is provided. In the machine shown, the workpiece is simultaneously rotated and moved axially with respect to the heat head during the heating and quenching cycle. The quenching device is raised and lowered by a cylinder in timed relationship to other machine movements. When the quenching device is in the lower position, the work is loaded into the fixture. Upon starting the automatic cycle, the quench device rises to a position just below the heat head, with both heating and quenching elements positioned in relation to the lower end of the workpiece bore.

Power is automatically applied, the quench following at the proper time interval to start hardening at the desired point, as the workpiece both revolves and moves downward. Automatic shut-off of power and water occurs at the bottom of the stroke, the quench device retracts and the part can be removed from the fixture. A change in set-up from one part to another takes 30-60 min., depending upon the skill of the operator.

Savings in Scarce Alloys

In the forepart of the article, it was stated that important savings in alloying materials and in steel tonnages can be realized through the proper application of induction hardening. As related to internal hardening applications, it has been found that wartime use of SAE 52100 steel may be replaced satisfactorily with SAE 1055 or 1065, at a considerable saving in alloys for products produced in large volume and with the saving in cost a secondary consideration. Who knows but that SAE 1040 steel will not prove entirely satisfactory for aircraft-engine cylinder barrels, for hydraulic cylinders used with landing gear struts, and similar military products which have consumed large quantities of alloy steels under existing specifications?

Important tonnage savings can be realized through the application of induction hardening to internal work in order to raise the physical properties of the metal. For example, a $\frac{1}{4}$-in. wall tubular part may be required to have a bursting strength of 6000 lb. per sq.in. If the bore is induction hardened, the physical properties of the

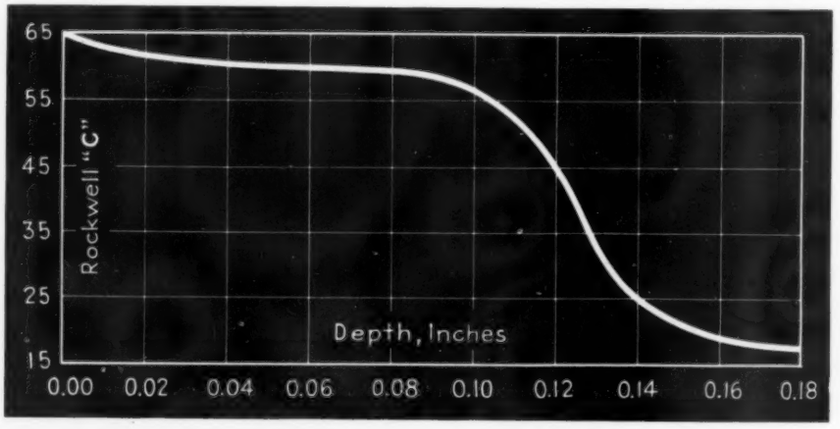


Fig. 8—Typical hardness distribution for a surface hardened by induction

Table IV—CASE EXAMPLES OF INDUCTION HEATING OF EXTERNAL WORK (Shown in Fig. 9)

No.	Part	Previous Heat-Treat	Operation	Machine Selected	Heating Cycle	Draw	Hardness
1.	Cam SAE 4340	.....	Harden periphery 1″ wide x $\frac{3}{64}$″ deep	150 KW 9600 cycles	16.5 Sec.	300 F.	58–60 C
2.	Gear, 2″ diam. x 8″ thick SAE 1045	Spheroidized	Harden halfway to holes	40 KW 9600 cycles	4.0 Sec.	300 F.	64–66 C
3.	Transmission Shaft CTIE 45	.....	Harden splined area continuously	150 KW 9600 cycles	0.3 In. per second	.....	53–54 C
4.	Axle SAE 1045	.....	Harden 2½ in. diam. x 8 in. long	150 KW 9600 cycles	133.5 Sec.	None	60 C
5.	Journal SAE 4140	To 35 RC.	Harden 4 in. diam. x 2 in. wide to $\frac{3}{16}$ in.	300 KVA 3000 cycles	14.4 Sec.	300 F. 1 hr.	60–61 C
6.	Reduction Shaft SAE 4140	262–321 Brinell	Harden 2.4 in. diam. x 2¼ in. length	150 KW 9600 cycles	23.5 Sec.	300 F. 1 hr.	62 C
7.	Gun Part SAE 1050	Hardened to 60C	Soften edges of groove	40 KW 9600 cycles	11 Sec.	.....	53–54 C
8.	105 mm. Steel Howitzer Case	Cold drawn	Anneal rim ¾ in. deep prior to forming	150 KW 9600 cycles	147 Sec.	.....	.....
9.	Steel Stamping	.....	Heat to 1400 F. adjacent to hole	40 KW 9600 cycles	4 Sec.	.....	.....
10.	81 mm. Steel Shell	.....	Braze seal nose assembly with silver solder	40 KW 9600 cycles	51 Sec.	.....	.....
11.	Shell Assembly, 2$\frac{15}{16}$″ diam. SAE 1010	.....	Braze base to tube, using Tobin bronze	150 KW 9600 cycles	24.5 Sec.	.....	.....
12.	Aircraft Cylinder Assembly Steel	.....	Soft solder	40 KW 9600 cycles	90 Sec.	.....	.....

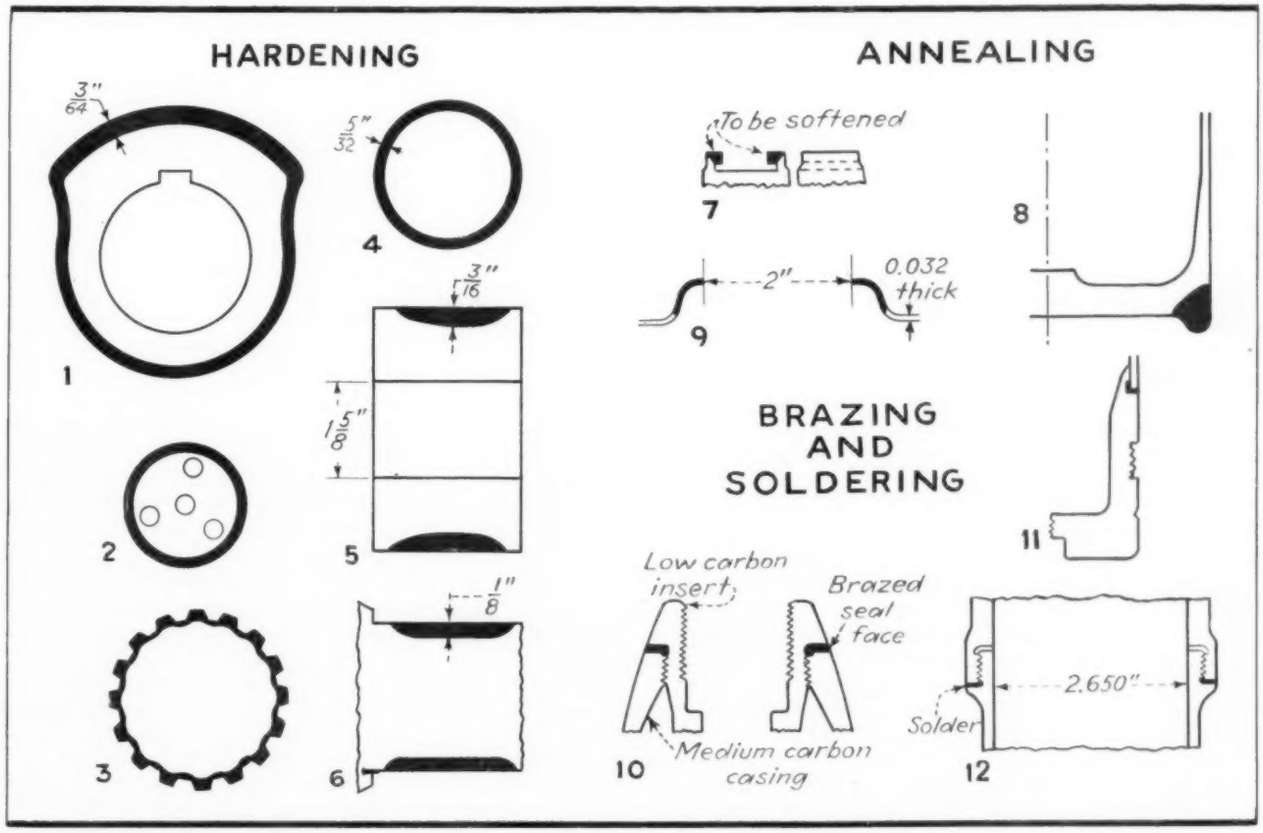


Fig. 9—Examples of induction heat-treating operations recently undertaken indicate the wide scope of application to munitions production

Curtiss-Wright Corporation

An aviation propeller shank is heated prior to upsetting. The heating cycle on this 100-kw. Tocco machine is extremely rapid which aids greatly in meeting the production schedule

metal are increased to the point that a thinner wall thickness is permissible. Another possibility is that a tubular part does not give satisfactory service life with an unhardened bore, but application of internal hardening raises the physicals, minimizes wear or scoring, avoids the need to specify a better grade of material. Thus, by proper engineering of steel specifications, and raising the physical properties of the metal through induction hardening, the collapse, bulging or wear of cylindrical parts can be avoided.

Design Considerations

The application of induction hardening to inside diameters should be considered by engineers during the designing stage, rather than depending upon the process to get them out of trouble. In one recent defense application, for example, the designers brought parts layouts to the induction heating specialists before the product was put into manufacture. Results obtained were: (1) detail refinements in design of the part to improve performance and permit maximum benefits from induction hardening of an I.D. and contours, (2) expensive later changes in production methods were avoided, and (3) literally millions of dollars worth of new machine tools were eliminated from the original conception of the proper processing layouts for the components of the product involved.

When alloy iron parts, such as diesel-engine sleeves, are induction hardened, the material must be free of sand holes, porosity, shrink spots or other heterogeneous areas that will cause localized overheating. Actually, the induction hardening process acts as a 100 percent inspection device, since it emphasizes such defects which may have escaped detection in prior examination.

As produced by one manufacturer, the bores of diesel-engine liners have a hardness of 52-55 Rockwell C to a depth of approximately 0.070 in. Gray cast iron, chosen for this application, develops a hard martensitic structure. Liners from 10 to 15 in. in length and with bores varying from $3\frac{3}{4}$-$5\frac{3}{4}$ in. in diameter have been treated. For a sleeve 15 in. long, the actual time required by the inductor block to complete the hardening stroke was nine seconds.

Steel cylinders are hardened in substantially the same way and at the same speed as iron cylinders. Steel has been hardened to 69 Rockwell C in depths from 0.025-$\frac{3}{8}$ in., while special cast steels have been hardened to 78 Rockwell C.

Shrinkage During Hardening

Despite these hardnesses, the material is machinable, being drilled or milled as required. Carbide tools have been developed for such work. Steel tubes with a hardened bore have been cut apart with lathe tools, and the tool marks show on both the hardened and unhardened zones.

Distortion is held to a minimum because only a portion of the piece is heated to critical temperatures. The bore tends to shrink by expansion of the martensite and is quenched before it returns to the original dimension. For an SAE 1065 forged-steel cylinder of $6\frac{3}{4}$ in. I.D., by $29\frac{1}{2}$ in. long, the shrinkage averaged consistently between 0.005 and 0.006 in. From 0.001-0.0015 in. per in. of diameter is common for shrinkage allowance. Actual thickness of the cylinder wall in relation to the depth of the hardened zone

Cleveland Tractor Company

Three 20-tooth tractor sprockets 28 in. in diameter are hardened at the rate of 15 an hour to 60 Rockwell C. They slide into the inductor of a Tocco, Jr. machine, are hardened and then indexed

and the presence of flanges or other variations of wall thickness affect distortion.

The absence of brittleness in the hardened zone can be demonstrated as follows. The unhardened exterior of a steel ring was machined off, and the hardened ring (Rockwell 60 C) could be thrown on the floor or compressed appreciably in a vise without cracking.

Bores of 2 in. to 15 in. in diameter are readily heat-treatable by induction, and progressively to any length within the machine's stroke. Diameters smaller than 2 in. and in lengths of 30 to 40 diameters can be accommodated. Hollow cylinders, down to 1½ in. in diameter, are being handled. In all cases the interval between heating and quenching is in the neighborhood of 0.20-0.25 sec. Few data are available on the heat-treatment of the smaller diameter pieces because of the cost of building the apparatus.

If desired, a small section of a previously hardened piece can be drawn or annealed to permit machinability. Brass cartridge cases for small arms ammunition are being mouth annealed at the rate of 100,000 per hour in a special machine which takes little space and permits a large increase in plant output. The same operation can be performed on steel shell cases. Annealing aluminum aircraft sub-assemblies after welding is also a current application. Continuous annealing of 1-in. 18-gage steel tubing requiring a temperature of 1600 F. for the operation is being carried out at the rate of 3,500 ft. per hour with an 80-kw. machine. In this application, pickling and handling time are saved.

Heat for Shell Forging

In forging shell, blanks are fed into induction heating furnaces where they are heated one at a time to 2350 F. Blanks for 75-mm. shell are heated in 2 min. 28 sec. With five furnaces, each of which takes small space and throws off little heat to the working area, a heated blank is delivered to the upsetter every 28 sec. Power consumption amounts to 0.22 kw. per pound of metal heated. Choice of induction heating for this application rests upon the fact that the soft scale on the billet is responsible for longer die life and less machine down time, factors which offset higher equipment cost.

A 75-mm. shell is being heated for nozing in 13.6 sec. with a 60-kw. machine. In heating 3 in. diam., ⅝-in. wall tubing for 81-mm. shell, a 10,000-cycle machine, rated at 40 kw., is producing 200 pieces per hour at a cost of 60 cents for power. The speed of heating for forming and forging operations frequently offsets power cost, with labor the criteria in selecting the heating method.

Newest development in the induction heating field is the production of composite structures through brazing and soldering. In the manufacture of chemical shell, brazing the base to the tubular portion confines the heat to the braze line, does not affect the physical properties of other portions of the projectile, and the seal is invariably sound. Greater economy is also secured because the entire shell is not heated. In one installation, the base of the shell is being brazed to the tube at the rate of 240 units per hour with a 20-kw. machine. Since exact control of heating time and temperature is obtainable, the assembly of munitions components can be undertaken with copper brazing wire, silver solder or 50-50 solder as called for in product specifications.

Gears and Gear Cutting

BY ALLAN H. CANDEE, GLEASON WORKS

II—Gear generation permits the designer to make desirable changes in tooth contours without the use of special tooling

A DESIGNER ought to know about the possibility of using standard tools and machines to generate teeth in gears of various diameters, and of cutting correctly conjugate teeth with modified addendums and thicknesses. He should also be acquainted with the reasons for wanting to do this.

In Fig. 19 the upper illustration shows the shape of teeth generated in a small pinion by a basic rack when the outside diameter and depth of cut are according to what are called standard tooth-form dimensions. The pinion here has only 12 teeth, and the result is to produce "undercut."

It is seen that the corners of the rack teeth generate comparatively large, concave fillet curves which weaken the pinion teeth and also slightly decrease the active portions of the profiles. For any given cutter or hob, the effect begins at some limiting number of teeth and increases as successively smaller numbers are generated.

Modified Tooth Stronger

A way to avoid this undercut is by not cutting so deep, or putting it a little differently, by increasing the pinion diameter. This is shown in the lower illustration, where the fillet curves are smaller and the roots of the teeth are thicker, although generated by the same basic rack. A pinion with dimensions changed from the basic standard in this way is called a "long-addendum pinion" or an "enlarged pinion." The different shapes generated in the two 12-tooth pinions are compared in the small diagram at the right, where the increase in tooth thickness and the change in diameters are apparent. If the mating gear has a sufficiently large number of teeth, its diameter can be decreased without objectionable effect, so that the standard center distance will be maintained.

Gear outlines shown in the manner of Fig. 19 serve to indicate that modern tooth design is based upon the generation of one gear from another. Exact curves on paper need not be constructed and copied in metal, as was done before generating machines were invented. Instead, a tool of standard form generates gears with various numbers of teeth, and the gears are made conjugate by using proper motions and adjustments in the generating machines.

Shop Layouts Not Needed

The man in the shop never sees a pitch circle or the drawing of a gear tooth, as they are not required in actual manufacture. Diagrams and layouts are used only by the calculator or engineer when he estimates strength or durability and when he may wish to study the effect of changes. It follows that the general designer probably will never have to draw a gear tooth, but he should know something about recognized tooth-form standards like those adopted and recommended by American Gear Manufacturers Association.

Fig. 20 shows one of these for 14½-deg. involute spur gears. Note that it includes a table of increases in pinion diameters, to improve generated tooth shapes in the manner which has been explained. This particular standard is one which has been adopted by the American Standards Association as well as by the A.G.M.A.

The designer should consult the gear-cutting department of his own shop or the outside gear manufacturer, in regard to the exact dimensions to be specified for gear blanks, because these may vary somewhat according to generating tools and machines that may be available. He should not for instance tie the hands of the gear manufacturer by having the outside diameters of blanks turned to dimensions taken from some old handbook and not representing up-to-date practice.

Bevel Gear Standards

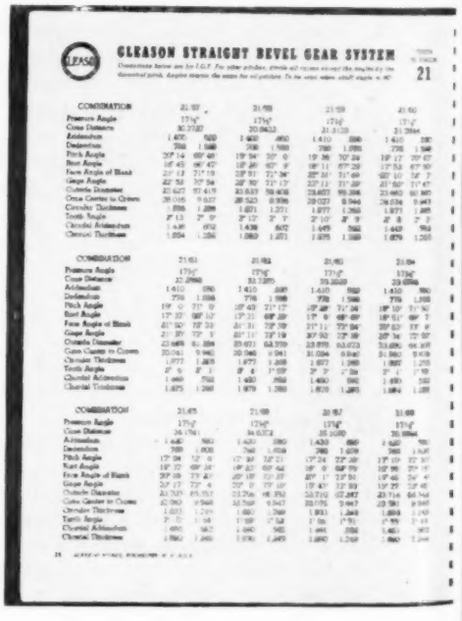
Standards for bevel gears are also available. Fig. 21 shows an extensive book of tables giving data in convenient form for dimensioning and generating gears according to the Gleason straight bevel gear system. This system was improved and revised in 1940, and is approved as a recommended practice by the A.G.M.A. There is a similar system for spiral bevel gears. In both systems long- and short-addendum proportions are used, which vary according to the numbers of teeth in pinion and gear.

In all cases the people who are actually to make the gears should be consulted for final details. Up-to-date tooth design does not increase cost because standard tools are used; it only requires that the designer get his data from the right source.

A point about gears too often overlooked is that accuracy in chucking or holding blanks in the cutting machines and accuracy in mounting and assembling gears with other parts, has just as much to do with accuracy of performance as the precision with which the teeth are cut. It is obvious that accurate cutting cannot be done without proper rigidity, and also that it is foolish to expend time and effort on accurate gear cutting and then fail to assemble gears so that they run true and are in correct position.

Chucking Must Be Rigid

The designs of chucking arbors, shown in Fig. 22, are the result of long experience. The two most important principles are that proper locating surfaces be provided and maintained with close fits, that the work be rigidly supported. It would be silly to expect to


GLEASON STRAIGHT BEVEL GEAR SYSTEM

21

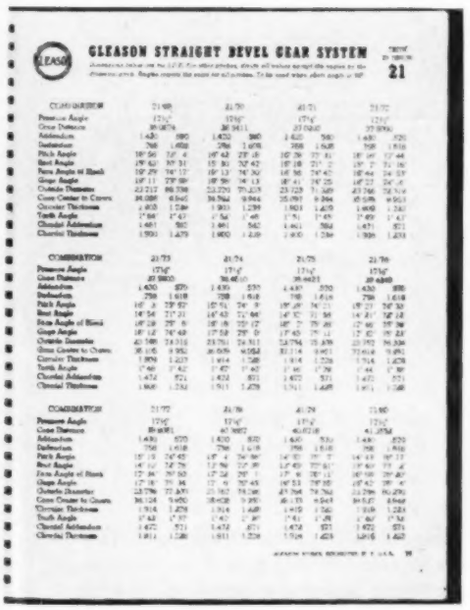
Old Design

Modern Design

Fig. 19—Improved tooth shapes in pinions with small numbers of teeth can be generated with standard tools

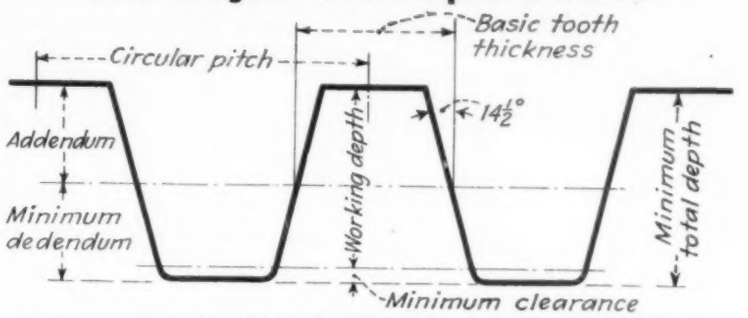
Fig. 20—The tooth-form standard for 14½ deg. involute spur gears, includes a table of diameter increments to decrease undercut

Fig. 21—The Gleason straight bevel gear system—revised in 1940—provides improved tooth design with standard methods


GLEASON STRAIGHT BEVEL GEAR SYSTEM

21

14½ Degree Full Depth Involute



FULL DEPTH TOOTH PROPORTIONS FOR SPUR GEARS

	In Terms of Diametral Pitch (In.)	In Terms of Circular Pitch (In.)
1. Addendum	$= \frac{1}{DP}$	$0.3183 \times CP$
2. Minimum Dedendum	$= \frac{1.157}{DP}$	$0.3683 \times CP$
3. Working Depth	$= \frac{2}{DP}$	$0.6366 \times CP$
4. Minimum Total Depth	$= \frac{2.157}{DP}$	$0.6866 \times CP$
5. Pitch Diameter	$= \frac{N}{DP}$	$0.3183 \times N \times CP$
6. Outside Diameter	$= \frac{N + 2}{DP}$	$0.3183 \times (N + 2) \times CP$
7. Basic Tooth Thickness on Pitch Line	$= \frac{1.5708}{DP}$	$0.5 \times CP$
8. Minimum Clearance	$= \frac{0.157}{DP}$	$0.05 \times CP$
9. Radius of Fillet	$= 1\frac{1}{3} \times$ Clearance	

N = Number of Teeth. DP = Diametral Pitch. CP = Circular Pitch.

DIAMETER INCREMENTS, PLUS AND MINUS FOR 1 DIAMETRAL PITCH

Number of Teeth in Pinion	Diameter Increment	Pinion Circular Tooth Thickness	Mating Gear Circular Tooth Thickness	Min. Number of Teeth in Mating Gear Avoiding Undercut	Min. Number of Teeth in Mating Gear Full Involute Action
10	1.3731	1.9259	1.2157	54	27
11	1.3104	1.9097	1.2319	53	27
12	1.2477	1.8935	1.2481	52	28
13	1.1850	1.8773	1.2643	51	28
14	1.1223	1.8611	1.2805	50	28
15	1.0597	1.8449	1.2967	49	28
16	0.9970	1.8286	1.3130	48	28
17	0.9343	1.8124	1.3292	47	28
18	0.8716	1.7962	1.3454	46	28
19	0.8089	1.7800	1.3616	45	28
20	0.7462	1.7638	1.3778	44	28
21	0.6835	1.7476	1.3940	43	28
22	0.6208	1.7314	1.4102	42	27
23	0.5581	1.7151	1.4265	41	27
24	0.4954	1.6989	1.4427	40	27
25	0.4328	1.6827	1.4589	39	26
26	0.3701	1.6665	1.4751	38	26
27	0.3074	1.6503	1.4913	37	26
28	0.2447	1.6341	1.5075	36	25
29	0.1820	1.6179	1.5237	35	25
30	0.1193	1.6017	1.5399	34	24
31	0.0566	1.5854	1.5562	33	24

All dimensions in inches.

cut teeth in a gear blank designed and held in the way illustrated in the incorrect example at the left.

Preferably the surfaces for holding the blank on the arbor should be the same as those used for mounting. This usually includes the bore. If the bore diameter is too small, however, the outside of the hub may be used, as in the lower drawing. Details of this kind are so important for accurate results that the general designer will do well to consult those familiar with good gear-manufacturing practice.

Theoretically a given gear and pinion are expected to run best exactly in the relative position for which they are designed. In manufacturing and assembling, however, reasonable tolerances must always be allowed. Relative displacements of a pinion and gear or of two mating gears, obviously will affect the tooth contact.

An experienced gear man always wants to see the tooth bearing in order to determine how correctly gears have been made and assembled. The tooth bearing is the area on a tooth surface which actually shows contact when gears are run.

For instance, if the shafts of spur gears are out of parallel or if those of bevel gears are out of line, the tooth bearing shifts to opposite ends of the teeth on the two sides, as is illustrated in Fig. 23, right. In the Zerol bevel gears shown, it is seen in the picture at the left that even in the correct central position the tooth bearing was less than full length. Referred to as "localized tooth bearing," this condition is of great practical advantage. With full-length tooth bearings, even the slight displacements resulting from tolerances in assembling or changes under load, at once shift the contact to the ends of the teeth, causing noise, wear and danger of breakage. In the right-hand picture of Fig. 23, however, the tooth bearing, although somewhat out of position is still such as to give quiet and safe operation.

Localized tooth bearing has always been a feature of spiral bevel and hypoid gears, where it is readily controlled in the manufacturing processes. Because of its demonstrated effect in improving gear performance, ways are being sought to introduce it in other types of gears.

The general features of tooth contact in spiral bevel gears are illustrated in Fig. 24. At any instant there is only a line of contact on any given tooth. As the tooth moves through engagement, the line of contact sweeps over the tooth surface. By selection of cutter diameter and control of the generating operation, however, tooth surfaces can be produced in spiral bevel gears, which give only the amount of tooth bearing desired.

Part 3 of this article will appear in an early number.

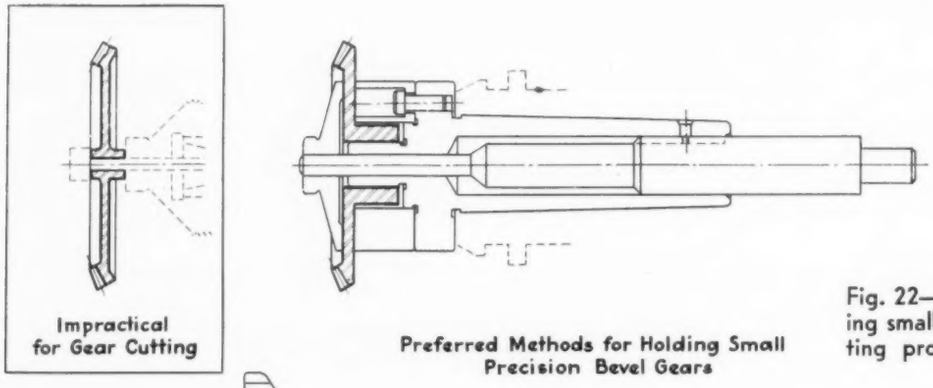


Fig. 22—Preferred methods for holding small bevel gear blocks while cutting provide accurate position and rigid support

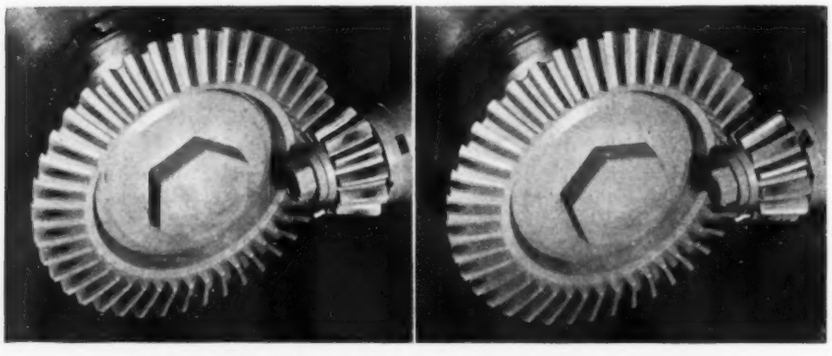


Fig. 23—The relative position of gear and pinion affects tooth bearing as exemplified by this pair of Zerol bevels

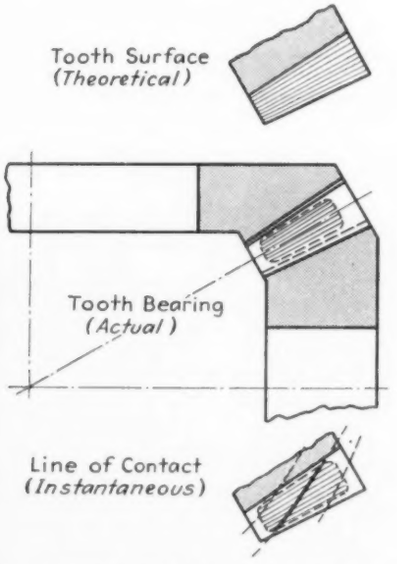


Fig. 24—In spiral bevel gears the instantaneous oblique line of contact sweeps across the active tooth surface

The Chemical Engineer cuts years to months...

Born in the turmoil of the last war, he is shaping a new world with mighty swords and magic plowshares

GERMAN CONSUL-GENERAL HOSSENFELDER, writing from New York on March 3rd, 1916, to von Bethmann-Hollweg, chancellor of the Imperial German Government, confidently predicted defeat for the United States because we were totally dependent upon the great chemical industry of Germany. "Americans," he wrote, "can never establish such an industry. They have the resources but they lack the necessary science and technology. And, besides, the conflicting selfishness of American business renders it impossible."

Even before the ink was dry on Hossenfelder's letter a new figure appeared on the industrial scene—the American chemical engineer. With the help of patient, but progressive and venturesome capital, he laid the foundations for the largest and most resourceful chemical industry in the world.

Today he is an all-important figure. For we are fighting a chemical war, even though the emphasis that is placed on planes, tanks, ships, guns and other armament tends to obscure that fact. And this chemical engineer is waging war for us on a prodigious scale. Bombers carry more tons of more deadly explosives because he has developed stronger and lighter alloys and more efficient fuels. Tanks are better armored and wield heavier blows because of products and processes born in chemical laboratories. Ships are welded together by new metallurgical techniques that save precious months over older processes. Gun barrels that are made in minutes instead of hours shoot farther and faster because of better ammunition.

And quantity keeps pace with quality. By mid-year of 1942, explosives were being produced in newly constructed plants twelve times faster than a year ago. Smokeless powder output has been doubled since December. Five times as much TNT was being made in July as in the months preceding Pearl Harbor. One single new plant produces more of this high explosive than did the entire pre-war industry—and several of these plants already are in production.

By what Major General William N. Porter, Chief of the Chemical Warfare Service, calls a "miracle of production," the sort of incendiary bombs that General Doolittle's lads showered on Tokyo were rolling out of our plants within a few weeks after we got into the war. As General Porter puts it, "they were rolling not by hundreds or even thousands, but by the millions." That record he has cited as a tribute to the "ingenuity, industriousness and patriotism" of the American chemical industries.

Yet the General agrees that we have only started to produce in the tremendous volumes that will shortly make Germany, Italy and Japan "revolve on their boasted Axis." Our newest plants are just coming into production. They face no limiting shortages of materials for, in the main, our chemical industry draws its strength from coal, salt, sulphur, limestone, oil, natural gas, coal-tar, air and water—all available in abundance.

We have heard little about the use of poison gas by our enemies. It may be that good reasons for this are stored away in our well-stocked chemical arsenals. American chemical manufacturers have worked hard and long with our armed forces so that if the time ever comes to make good on the President's warning of retaliation, America will be more than ready.

And defense against gas has not been overlooked. Every soldier is equipped with a most efficient type of gas mask, developed through twenty-five years of intensive research. The Chemical Warfare Service already is manufacturing millions of masks for distribution to civilians. Let us hope we may never have to use them. But if we must, we need have little fear of any gas or secret chemical.

This gas mask program has been made possible by a literal metamorphosis of production facilities, as peacetime industries have been converted to war purposes. A lumber company, for example, is making activated carbon from sawdust. Novelty manufacturers of rubber goods are turning out valves and assembling other parts. Former manufacturers of shirts, swim-suits, shoes and beds have converted their facilities and are contributing their share. More than eleven hundred contractors and two hundred and fifty sub-contractors are supplying their full quotas of chemical warfare materials. And production is right up to schedule.

But the bulk of the war job of our chemical industries has to do with items other than weapons and

ammunition. The German Consul-General, in that 1916 report to Berlin, said that many American industries were in a critical condition because of the scarcity of German chemicals. He related in particular that "the cries for help from the world of physicians are becoming louder and louder and more and more insistent." Thanks to our chemical industries this cry no longer is heard. Even though we are again cut off from quinine, camphor and some other strategic medicinals, our homes and hospitals are adequately supplied with synthetic products. Most of these are better and cheaper than the natural materials. The same sulfa drugs that have saved so many civilian lives in recent years have gone to war, with the result that deaths from infection at Pearl Harbor and Bataan are reported as surprisingly low. In this war we suffer no shortages of iodine and potash. Pioneering research in the field of vitamins has led to new industries that are contributing to health and better nutrition.

Those new uniforms the soldiers are wearing are of better quality and will last longer than the shoddy, ill-fitting outfits of 1918—thanks to sunfast dyes and new man-made products. And in the field of fabrics, nylon and the new rayons have gone to war in parachutes and super-strong cords for tank treads and tires.

* * * * *

And that brings up the question that 30,000,000 American motorists are asking with ever increasing concern. "When, Mr. Chemical Engineer, are you going to give us a set of new tires for the old family bus?"

That, I am told, is just what the chemical engineers have set about to do on a scale that is difficult to comprehend. In the words of Raymond Clapper, the columnist, "the synthetic rubber program for this year and the next is the biggest job of chemical engineering ever undertaken in the world." A billion dollar industry is being built at record speed to make almost a million tons a year of chemical rubber to serve our war needs and those of our allies. This cannot be accomplished overnight. Many months are required to design and fabricate complex equipment, much of which must be made from corrosion-resisting metals and alloys. We shall be lucky if a tenth of the desired capacity is in continuous production this year and even more lucky if, by the end of next year, the new industry should be turning out synthetic rubber at a rate of 875,000 tons—using both petroleum and grain as raw materials.

All this, of course, must go for essential military uses but there is reason to believe that in the laboratory and pilot-plant stages we have some promising substitutes and stop-gap materials that may tide us over until the big program starts rolling.

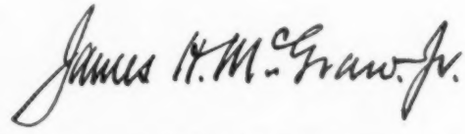
The present prospect of real success is possible only because of the cooperation of the chemical, rubber and petroleum industries. Individual firms and entire industries have set aside their normal desires and selfish interests to pool their patents, share their research and engineering developments for the common good. Synthetic rubber is here to stay as the basis for a great post-war industry: no doubt as to that lingers in the minds of the men who have seen many other natural products—indigo, alizarine, camphor, vanillin—all eventually fall before the ingenuity of the chemical industry.

* * * * *

In the coming peace to which we look forward hopefully, we shall find a new world full of new materials, new conveniences, new jobs, new opportunities, all stemming out of the present-day work of the chemical engineer. The same tough, transparent plastics that now make noses for bombers will give us new frameless windows for our homes and automobiles. With capacity to produce at least 2½ billion pounds of aluminum, which is five or six times pre-war production, and a magnesium capacity 50 or 60 times the pre-war figure, many new uses will develop for these structural materials of great strength and amazing lightness. Almost anything that flies, runs, moves, or otherwise is motive, will have a place for them. New fibers such as nylon and vinyon had scarcely got started before they were put to war use. Once the war is over they will be with us in greater abundance and at lower cost for a variety of uses so vast and so diverse that we can scarcely imagine them.

And the chemical engineer continues to create and to invent. He meets the challenge of scarcities and shortages with ever new "substitutes" that excel their originals. Even before the war is over he will have placed at our command a hundred new materials which we did not have before. His workshop is all industry. His contributions are as limitless as are our needs.

But right now his all-important job is to help win the war; to fight to a finish the ruthless and resourceful enemies that are devoting all their science and technology to bring about our defeat. So, as we take stock of our assets in this desperate struggle, we count among the first the proved resourcefulness of the research-minded chemical engineers we now have mobilized to help us fight this chemical war.



President, McGraw-Hill Publishing Company, Inc.

This is the fourth of a series of editorials appearing monthly in all McGraw-Hill publications reaching more than one and one-half million readers.

A new machine tool hand at The Aviation Corporation's Lycoming Division plant, getting some pointers from an old-timer on filling out his machine tool operator's questionnaire. Although new men are asked to write out their answers at home, they are encouraged to seek information while on the job at the plant.

Written Tests Aid Worker Evaluation

How much should a new machine tool operator know of his work after a few weeks experience? How can a company determine if he meets the minimum standard?

A GOOD FOREMAN can pretty well size up a green hand after spending some time with him. But in the present expansion period a foreman isn't able to spend much individual time with all his new men. With so many green hands to be considered, it is important to establish some standard for evaluating each of them.

In this connection, a series of written questionnaires for job-testing developed by the personnel department of the Lycoming Division of the Aviation Corporation is attracting considerable interest.

Lycoming, manufacturer of radial and horizontally opposed airplane engines, has almost quadrupled its shop personnel in the last two years, and is still expanding. In breaking in new machine tool operators the company has adopted the widely-used plan of assigning a new hand to the machine of an older, experienced operator under whose supervision the new man gradually takes over. In a few days or a few weeks, the novice, who is usually a graduate of the local public vocational school, is able to handle the machine entirely alone and is then generally transferred to the second or third shift.

The company makes sure, however, that before the new man is put in full charge of a machine he satisfactorily answers a written questionnaire about that machine. The questionnaire consists of three parts:

1. A drawing (or, in some cases, several drawings) of the machine with arrows pointing to all the important

levers, wheels, buttons, and other controls. The operator must name and explain the use of all these controls, using spaces provided on several sheets of the questionnaire for the answers.

2. A series of 15 to 30 questions (depending upon the complexity of the machine) about its operation, such as the setting of the cutters, selection of spindle speeds, use of hand adjustments, the handling of chucks and arbors, lubrication, etc.

3. A series of 14 questions (standard for all operators) on general shop practice. Typical questions here are: What would you do in case of an oil fire? Who should be the first one to know of a mistake made or discovered by you? How often should your gages and micrometers be checked?

Replies Require Research

The questionnaire is given the new man within a few days after he first goes to work and he is asked to fill it out at home. Some questions can be answered in a single word, others take a paragraph. Many require the operator to use initiative in that he must find the department foreman for some answers, look up the machine manufacturer's manual for others, and generally ask his instructor and foreman quite a number of questions.

Lycoming people feel that the questionnaire serves a number of useful purposes. For one thing, it establishes a minimum standard for new hands, making certain the operators of general-purpose machines aren't "one-operation" mechanics. Some operators, never learning the purpose of all the controls, fail to get out of a machine anywhere near the efficiency that is built into it. On the other hand, an operator who is familiar with all his controls is likely to use them.

The questionnaire also provides the green hand with a guide for learning. He finds out by this means what the company expects him to learn about his machine, what the company considers important. And he knows what questions to ask. In the same way it makes certain that the older operator-instructor doesn't hold back any important information. Very little of this attitude still exists today, but there sometimes is a tendency on the part of older men to limit their help to new men for fear the younger ones will get their jobs.

The questionnaire is further considered valuable in that it goes far to determine a man's interest in his job. It accentuates outstanding men and men who have unusual ability in certain other types of work, as well as those of lesser ability who need help. This shows up in the way a man answers the questions, his thoroughness, the sketches he makes, how promptly he returns his papers, etc.

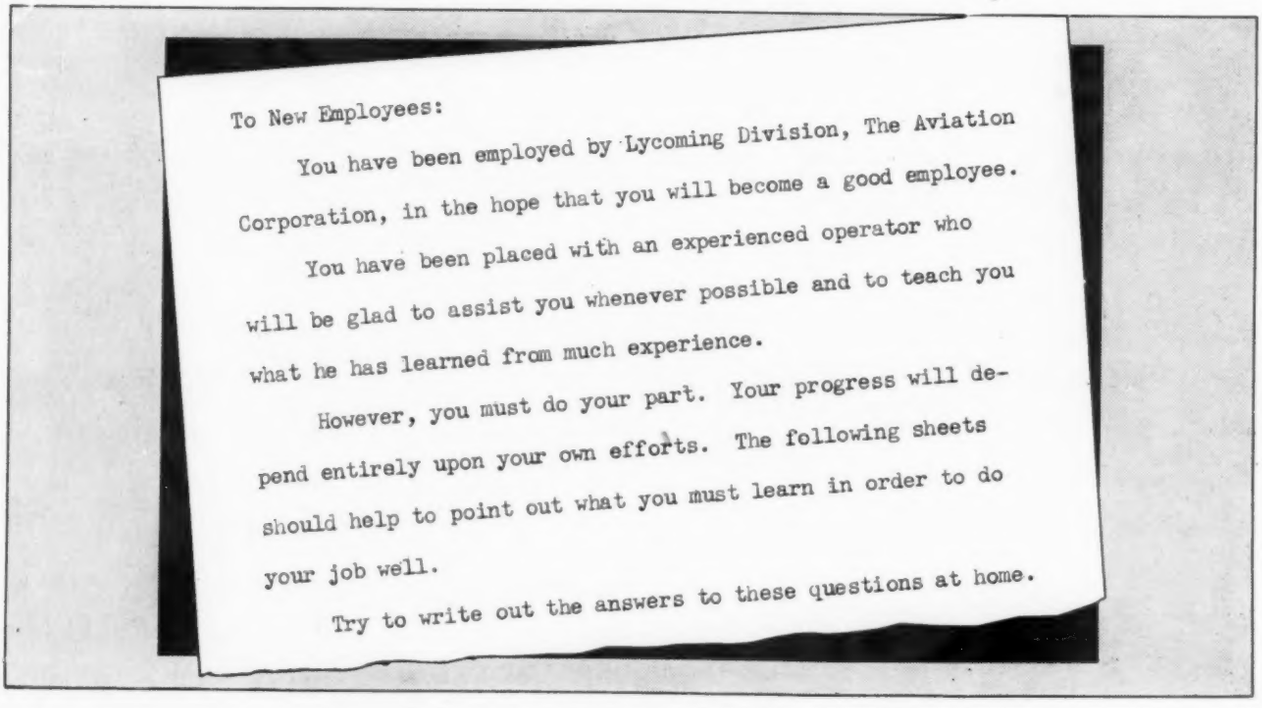
Sometimes shy and backward men, for example, who haven't sold themselves as well as they might have in personal interviews, are shown to have unusual ability, while on occasion others who can talk persuasively are shown to have less ability than had been thought.

A new man is not rated solely on this paper work. The questionnaire is simply a supplementary means of evaluating him. In cases where the instructor and foreman are undecided about a new man, the questionnaire is very helpful.

Tests Thoroughly Developed

Lycoming has already given the tests to hundreds of men. With the help of their most experienced old hands and the cooperation of the builders of the various machines, the company has developed questionnaires on the operation and set-up of some 60 different standard machine tools. These include everything from simple single-spindle drill presses to thread grinders, six-spindle automatic screw machines and specially designed horizontal multiple drilling machines.

The questionnaires are prepared in sets. Each set is prefaced with a general form letter telling the employee the purpose and value of the questionnaire. Following are 14 general questions asked of all operators. Next is a full page drawing of the machine the employee is learning to operate, with various parts lettered for easier reference. Ensuing pages include blank forms for filling in the names of the various machine parts, and a set of questions concerning the operation of the machine.



To New Employees:

You have been employed by Lycoming Division, The Aviation Corporation, in the hope that you will become a good employee.

You have been placed with an experienced operator who will be glad to assist you whenever possible and to teach you what he has learned from much experience.

However, you must do your part. Your progress will depend entirely upon your own efforts. The following sheets should help to point out what you must learn in order to do your job well.

Try to write out the answers to these questions at home.

A general form letter prefaces each set of questionnaires

General Questions for All Operators

Employee's Name

Golden Rule of the Machine Shop

Leave the machine for the next fellow as you would have him leave it for you.

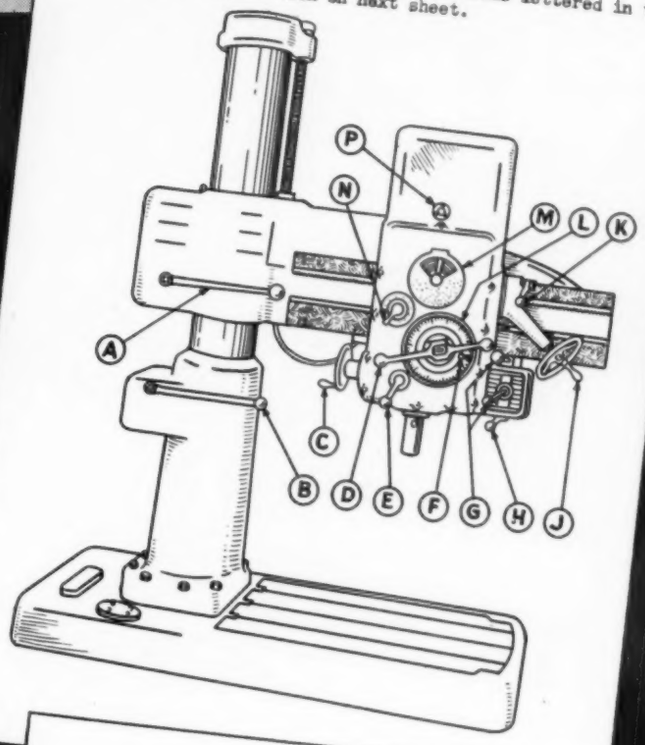
Directions: Find out and write answers to the following questions. It is suggested that you write out the answers at home.

1. What would you do in case of an oil fire?
2. What would you do in case of a magnesium fire?
3. What would you do in case of an electric fire?
4. What would you do in case of a paper fire?
5. What precautions should be exercised in the use of an air hose?
6. What do you do in case of an injury to yourself, no matter how slight?
7. What precautions should you take before starting on a job left by someone else?
8. Who should be the first one to know of a mistake made or discovered by you?
9. What precautions should be taken when working in the vicinity of flying particles?
10. What would you do if a fellow workman receives an electric shock and cannot let go while working at his machine?
11. What would you do if a fellow workman becomes caught in his machine?
12. When do you use gages provided for the job?
13. When do you use micrometers of the various types?
14. How often should your gages and micrometers be checked?

Radial Drill Press.

Directions:

Name and explain the use of all controls lettered in the sketch. Write explanation on next sheet.



Radial Drill Press

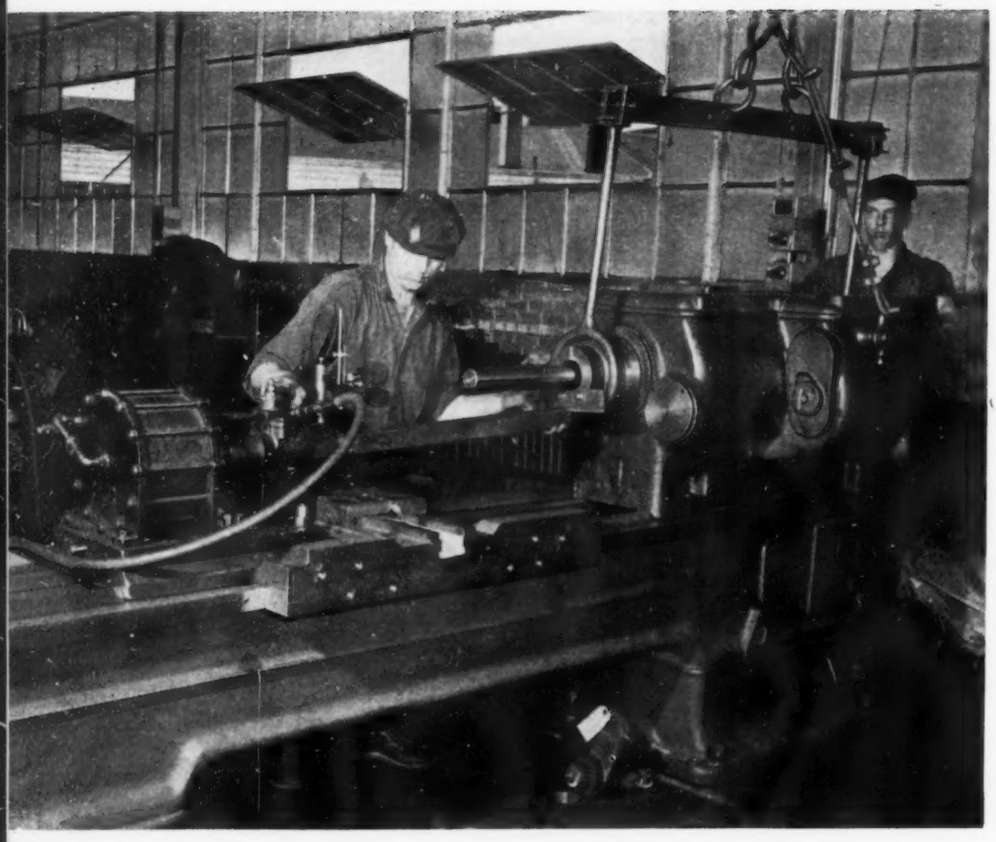
Employee's Name

1. How do you start the spindle?
2. How do you reverse the spindle?
3. How do you stop the spindle?
4. What is the spindle run left handed for?
5. How do you change speeds? Explain fully.
6. How do you start the downward feed?
7. How do you set the drill to a given depth?
8. How do you move the head on the arm?
9. How do you raise, lower and clamp the arm?
10. What causes a drill to cut oversize?
11. What precautions are necessary in loading a jig for drilling?
12. How is the depth of a drilled hole measured?
13. Explain purpose and operation of oil filter.
14. Give complete directions for oiling the machine.
15. What is meant by the lip of a drill?
16. What is meant by flutes on a drill?
17. What is meant by clearance?

Before being given full responsibility for their machines, operators are handed a general series of questions for which they must supply answers

In addition, each novice operator receives (right) a drawing of the machine he is to operate, along with a series of specific questions thereon

Shop



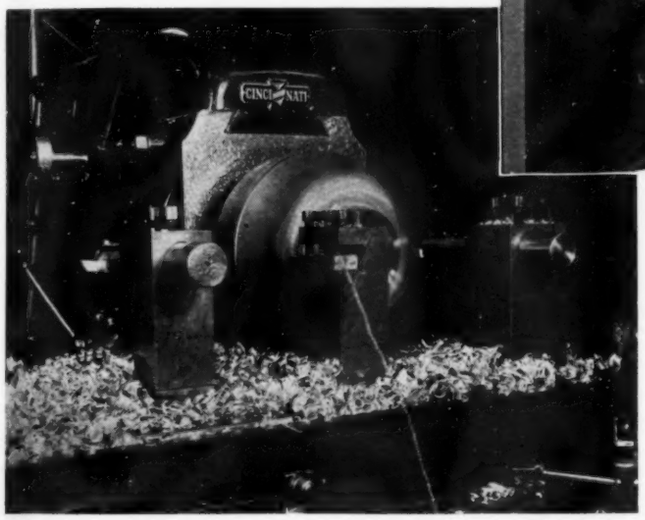
Mechanical elbows save time and tempers when scraping in headstocks and carriages on the finished ways of lathe beds. A pneumatic cylinder, with a support bearing for the reciprocating piston extension, is mounted on a plate machined to fit accurately on the ways of the bed. By simply connecting the piston extension to the headstock or carriage with a bar, and then operating a control valve, the workmen easily can move the subassembly back and forth on the bed ways to get a bearing indication. As a further aid toward speeding up this normally slow operation, special lifting devices have been developed. The Monarch Machine Tool Company.

Drill jigs permanently mounted have facilitated production of switchgear parts. It is no longer necessary for the operator to center the jig under the drilling spindle. The operator merely lifts the jig plate with his left hand and replaces the piece to be drilled with his right hand. When the drill spindle has descended a predetermined distance, it returns automatically. J. H. Penney, Switchgear Division, Westinghouse Electric & Manufacturing Company.

Magnetic inspection of reduction gears for aircraft engines has been speeded up by using this brass rack to handle six gears at a time. Small brass projections spotted along the uprights serve to hold the parts away from the supports as much as possible. Brass is used because of its non-magnetic properties; otherwise the lines of magnetic force used to detect defects would be deflected. Prior to the development of this rack, the gears were dipped into the oil tank by hand, one at a time. Donald O'Brien, Wright Aeronautical Corporation.

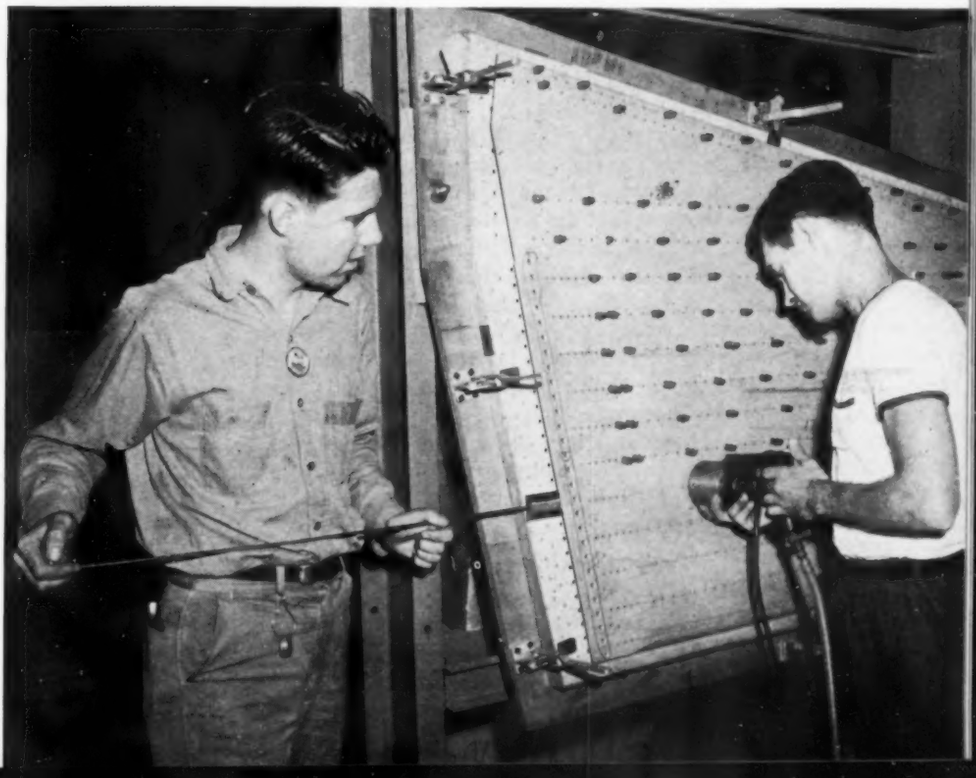
Shots

Holsters are back in use again "way out west" where men are making bombers instead of riding the range. These holsters are for electric drills, rather than six guns, and are made of sheet steel with a bracket at the back and a notch for the trigger at the front. The rounded pocket permits the drill to rest on its frame, with its chuck and drill bit protruding through the opening in the lower end. The holsters are bolted to the edge of the workbench and hold the electric drills in convenient position. Conceived by Douglas R. Fick, they are used throughout the plant, and are credited with preventing much drill breakage. Vega Aircraft Corporation.

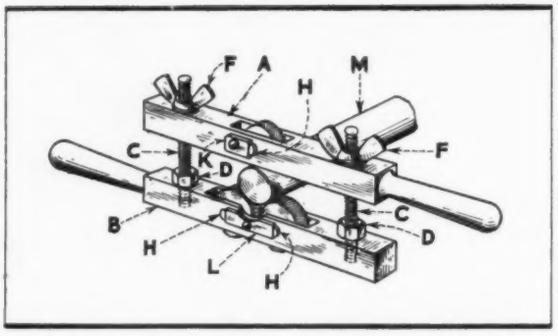


Multiple operations are saving production time in the machine shop of the new Texas plant. Oleo knuckles are machined on a No. 3 milling machine, using carbide tools. At the left a tool which rough bores the knuckle, a duralumin forging. The center tool rough and finish faces the back of the knuckle, using two tool bits. The tools at the right finish bore and cut a 45-deg. chamfer. The work held in a chuck on the spindle of the miller, is rotated at 450 r.p.m., and table feed at each position is $3\frac{5}{8}$ in. per min. This arrangement has cut approximately in half the time formerly required for machining this part. North American Aviation, Incorporated.

"Mouse Bar" is what assembly workers call this remote-controlled rivet bucker used in connection with a magnetic riveting gun to set rivets in places inaccessible to bucking and riveting under old methods. The bucking bar, which is drawn through narrow channels by a wire or small rod, as shown, is magnetized and thus drawn up firmly against the rivet at the moment the riveter presses the trigger of the special riveting gun. This ingenious development won a $2,500 Revere award for William Holcomb, assistant superintendent of new developments, as it was named one of the most noteworthy devices to speed production in the aircraft industry. It is no longer necessary for the "bucker" to insert his arms or hand in openings behind the rivet to hold a bar in place manually. Lockheed Aircraft Corporation.



IDEAS FROM PRACTICAL MEN



This hand-knurling tool can be used on work held in lathe or drill press chucks, or in a bench vise

Hand Tool Knurls Small Parts

By AUGUST KUEHN

Where small quantities of parts are to be knurled, a hand tool like that shown in the drawing will save considerable time. The work can either be rotated slowly, with the tool held by hand to prevent it rotating with the work, or the work may remain stationary with the tool rotated around the work by hand. With this type of tool, there is no side pressure against the work and spindle bearings, as when using a regular knurling tool in the toolpost of an engine lathe. Another advantage is that the turning tool need not be removed from the toolpost, since the lathe carriage can be moved aside and this tool applied.

In this hand knurling tool the bar *A* carries one knurling roll while the lower bar *B* carries two rolls spaced equal distances on either side of the center axis of the top roll. Bar *B* carries two threaded studs *C* which are locked in position by nuts *D*. Bar *A* is drilled with two holes of sufficient diameter to permit a sliding fit over the two studs. Wingnuts *F* are provided so that the upper arm can be locked in position on the work when the tool is to be used. Each of the knurling rolls is mounted on a hardened steel pin of such diameter that the roll turns easily on the pin without play. The pins are pressed into holes drilled in the bars, and the head of each pin is cut away for the locks *K* and *L* which are small pieces of cold-rolled steel held in position on each bar with small machine screws. The clearance slots in each bar are carefully cut to provide a smooth running fit for each of the knurling rolls, but no more clearance than is necessary can be allowed, since the rolls should be held in accurate alignment.

When the tool is to be used, the wingnuts *F* are loosened and the bars *A* and *B* are moved apart until the knurled rolls can be passed over the work *M* as shown. When the tool is in position, the two wingnuts are tightened until the knurls bite into the work.

Producing Multiple Threads

By G. V. BRADBURY

When no indexing method with respect to the lathe spindle is available, multiple threads can be cut by using the following method, let m be the multiplicity of the thread to be produced and l the lead. That is, m is 2 for a double thread, 3 for a triple thread and so on. Let n be the threads per inch as measured by a thread gage. We consider n an integer in the cases treated herein. We find $l = \frac{m}{n}$ With the leadscrew of the lathe idle, we presume the thread dial to make one revolution in 4 in. of carriage travel. Let N = number of threads per inch on the leadscrew, so $\frac{1}{N} = L$, the lead per revolution.

Now after cutting the first thread on a piece which is to be multiple threaded, and with no indexing method available, we note that it is possible to move the carriage by an amount equal to any multiple of L, that is, L, $2L$, $3L$, and so on, by releasing the half-nuts and picking up another position. To cut the next thread, we wish to move the carriage by an amount $\frac{1}{n} = \frac{l}{m}$ with respect to the leadscrew. Other amounts will also accomplish the desired result, as will be shown.

Suppose the thread is double, that is, $m = 2$. Obviously if we move the carriage by any even multiple of $\frac{1}{n}$ we are back in the same thread again, but any *odd* multiple will do. Again, if $m = 3$, we cut the other threads by moving the carriage $\frac{1}{n}$ and $\frac{2}{n}$, or $\frac{4}{n}$ and $\frac{5}{n}$, or $\frac{7}{n}$ and $\frac{8}{n}$, and so on, so that our first movement is $\frac{1+km}{n}$ and our second is $\frac{2+km}{n}$, where k is an integer we place in either case. In general, for any multiplicity, m, the carriage must be moved $m-1$ times, these movements being $\frac{1+km}{n}, \frac{2+km}{n}, \ldots \frac{(m-1+km}{n}$, where k can be any integer in any case. As the dial is marked uniformly, it is obvious that if we can produce the first carriage movement, then we can produce each subsequent movement, for they are all equal. By proper marking on the threading dial we can pick up (or drop) as little as $L = \frac{1}{N}$, or any multiple thereof.

Hence, if we can solve the equation $\frac{1+km}{n} =$

$\frac{K}{N} = LK$, in integers, then we will be able to cut the desired multiple thread. We proceed to consider the cases where $N = 6$ or $N = 8$, for double and triple threads. For $N = 6$ we have:

$$6\ (1 + 2k) = nK \quad \ldots\ldots\ldots\ 1.$$
$$6\ (1 + 3k) = nK \quad \ldots\ldots\ldots\ 2.$$

In the first case, n can be any number not divisible by 4, and in the second case, any number not divisible by 9. For $N = 8$:

$$8\ (1 + 2k) = nK \quad \ldots\ldots\ldots\ 1.$$
$$8\ (1 + 3k) = nK \quad \ldots\ldots\ldots\ 2.$$

Here, in the first case, n can be any number not divisible by 16, and in the second case, any number not divisible by 3.

As an example, suppose it is desired to cut a double thread with 36 threads per inch. We select leadscrew gearing for 18 threads per inch. We note that 36 is divisible by four; hence a six-thread leadscrew will not do, and we select a lathe with an eight-thread leadscrew. Then

$$8\ (1 + 2k) = 36K$$
$$2\ (1 + 2k) = 9K$$

Set $K = 2$ and $1 + 2k = 9$ is soluble with $k = 4$. The thread dial is already divided into eight divisions corresponding to $\frac{1}{2}$ in. per division or four leadscrew threads. As $K = 2$ we only want two leadscrew threads. We can scratch marks on the dial halfway between the existing marks. Our carriage shift is therefore $\frac{1}{4}$ in. $= \frac{9}{36}$ in. $= \frac{1}{18}$ in. $+ \frac{1}{36}$ in. So that the shift is $4\frac{1}{2}$ times the lead on the piece, where the $\frac{1}{2}$ is all we care about.

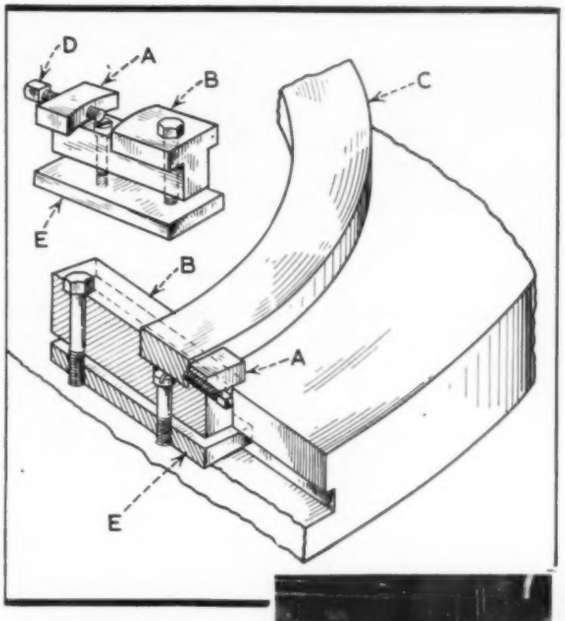
It might be better to make an extra mark on the dial housing instead of marking the dial, since one can identify such marks more easily. Naturally, the same precautions about closing the half-nuts exist in this discussion as always. The writer has had no trouble in teaching this method to an intelligent man after figuring out the set-up. However, it is hardly to be expected that the machinist who is always in hot water with loose change gears could apply it from the start.

Facing Locomotive Packing Rings

BY A. H. CARROLL

Locomotive packing rings are machined from cast-iron tubs. We machine the top surface square before each ring is cut from the tub, but rather than attempt to hold the cutting off operation to a close tolerance the ring is removed leaving several thousands to be faced off during a later operation. The holders used during this facing operation are shown in the illustrations.

Three to six such holders can be used on the boring mill, depending upon the degree of accuracy desired. The holders are machined from mild steel and fit into the bolt grooves on the boring mill table. Each holder is so made that the packing ring will lie flat on the face of the machine table, and between jaws *A* and *B* of the holder. This is done by designing the holders so that the inside jaw *B* is of the same radius as the inside diameter of the packing ring *C*. The outside jaw of each holder



Locomotive packing rings can be faced on the boring mill with the aid of these holders. The jaws of the holder are contoured to fit the diameters of the packing ring, which are held by setscrews against the inside holder jaws

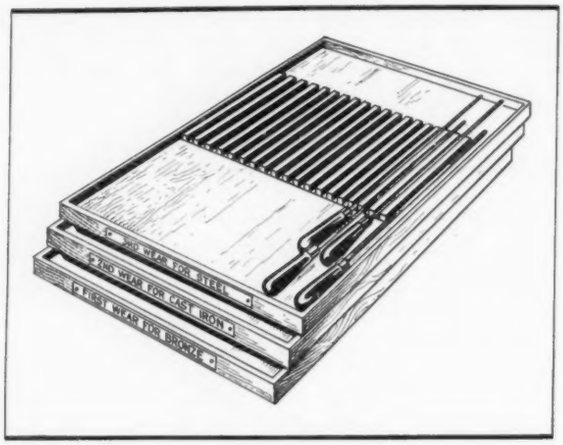
is drilled and tapped for a $\frac{3}{8}$-in. setscrew *D*, holes for which are set 2 or 3 deg. above horizontal.

Each holder is held on the boring mill table by bolting to $\frac{1}{2}$-in. plate *E* which fits in the bolt groove on the table. A fillister head screw is used at the back end of the holder directly beneath the fit for the packing ring. A hexagon head bolt is used at the front of the holder, since it does not interfere with the packing ring during the machining operation.

Drawers for Hand Files

BY MARTIN H. BALL

Hand files are often bench stored when not in use in such quantities that they are injured by workmen digging through the collection in search of the proper file. This can be avoided by storing files in a set of drawers divided into compartments each of which is intended to hold only one file. The depth of the drawers can be made so that they will not close if more than one file is placed in a single compartment. The size and arrangement shown in



This compartment arrangement for hand files prevents damage resulting from loose storing of the files and divides them by various degrees of wear

the drawing was for an average set of files, but can easily be varied to meet individual requirements.

To conserve space and to give room for picking up the files, the handle of one is placed to the front while the end of the next is placed against the back.

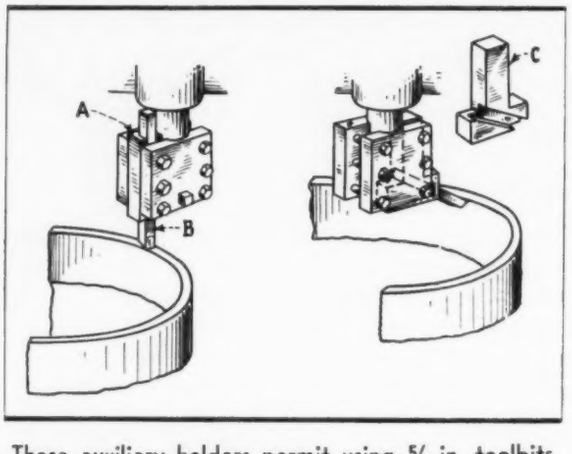
Since a sharp edge is required for proper filing of brass or bronze, one of the drawers was marked for first use on brass. After the keen edge has been worn off the file can still be used on cast iron and those in that condition were placed in another drawer marked second wear for cast iron. Similarly, the third drawer was marked third wear for steel.

Holders for Undersize Toolbits

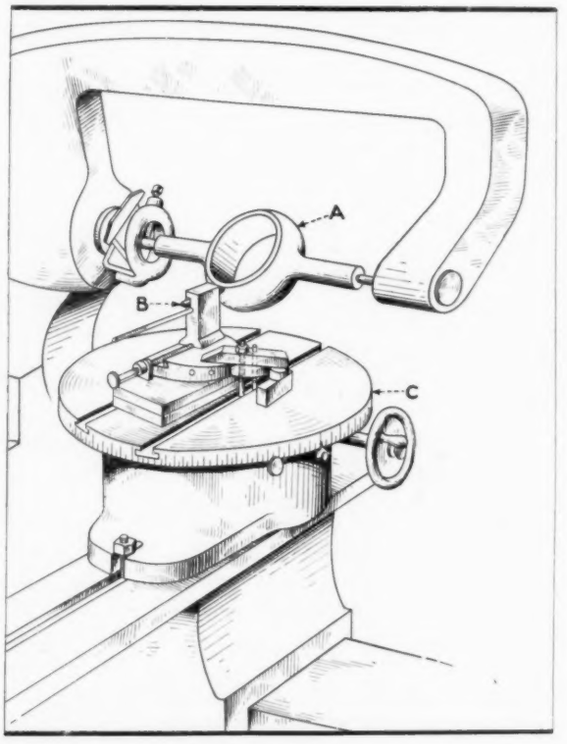
BY JOHN DEERING

There are many occasions when a machinist would prefer to use a standard toolbit, but due to the type of toolpost used or the inability to secure the correct size toolbit he has to be satisfied with hand-forged carbon steel tools. Faced with this situation, one of our machinists made the illustrated holders, whereby he could use $\frac{5}{8}$-in. toolbits in a toolpost designed for 1-in. tools. Tool holder *A* for the straight facing tool *B* was simply a piece of $1\times1\frac{1}{4}$-in. tire steel with a $\frac{5}{8}\times\frac{5}{8}$-in. slot milled therein. The $\frac{5}{8}$-in. toolbit is inserted in the holder, and the setscrews in the toolpost tightened directly on it.

A similar holder *C* was made for boring tools. This was also formed from $1\times1\frac{1}{4}$-in. tire steel shaped to form an inverted T $\frac{3}{8}$ in. wide and $4\frac{1}{2}$ in. long. The $\frac{5}{8}$-in. slot in this holder starts at the lower right hand corner and extends across the T at a 45 deg. angle. The top setscrews in the toolpost tighten on the holder, while the bottom setscrew tightens directly on the toolbit in the slot.



These auxiliary holders permit using $\frac{5}{8}$-in. toolbits on the boring mill with a tool head designed for 1-in. tools



A spherical surface can be turned on a milling machine by mounting the parts in place of the arbor, and mounting a rotary table below

Spherical Radius Cut on Milling Machine

BY S. D. McINTOSH

Several methods of turning the spherical portion of steel yoke *A* on an engine lathe were tried but failed because of the accuracy and smooth finish required.

It was found that the yokes could be turned by placing them between centers on a standard milling machine in place of the regular cutter arbor. Tool slide *B* was bolted to rotary table *C*.

The center of the rotary table was rotating exactly under the center of the spherical portion of the yoke, and a tool bit fastened in the slide and adjusted to turn the proper diameter. With the milling machine turning the yoke, the tool generated a perfect sphere by revolving the rotary table.

Armament

SECTION OF AMERICAN MACHINIST

Unleashing the Thunderbolt

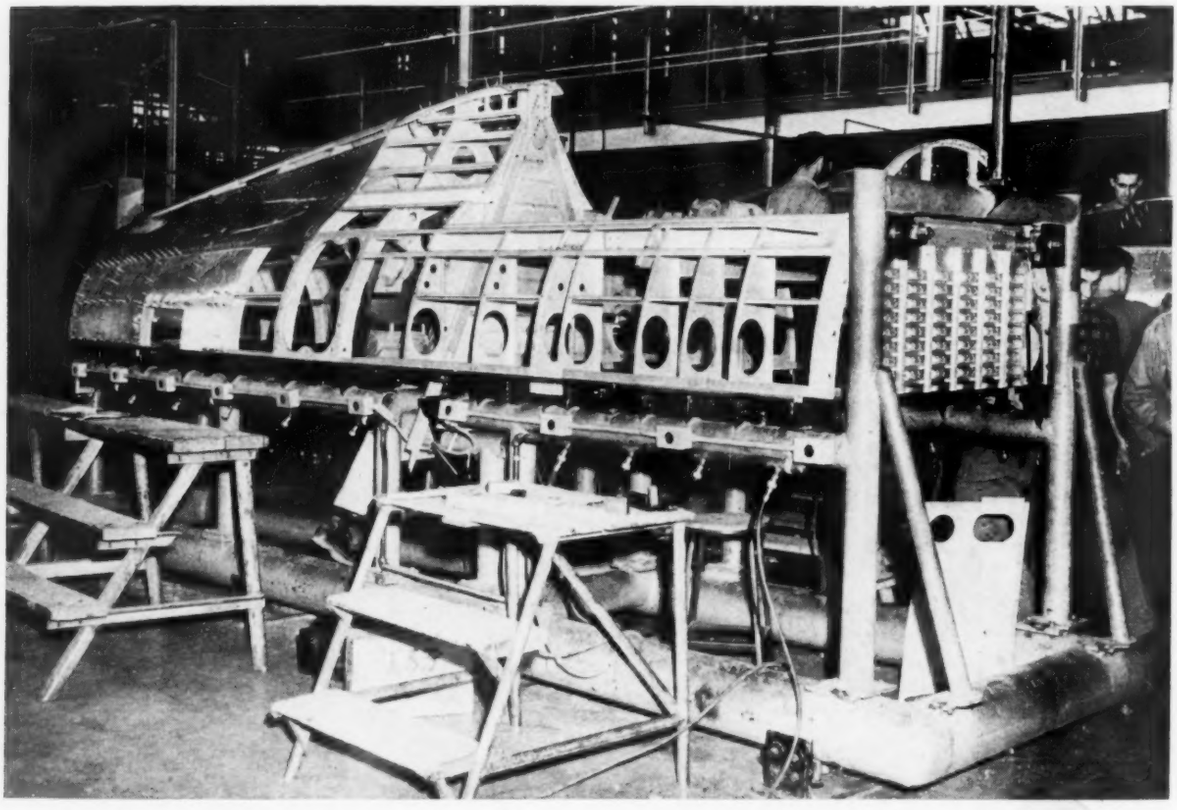
By O. G. PYLER
Tool Engineer, Republic Aviation Corporation

Jigs for Republic planes are made from standard tubular sections. Toolmakers work from perspective sketches when building the jigs, and take dimensions from detailed drawings of plane parts

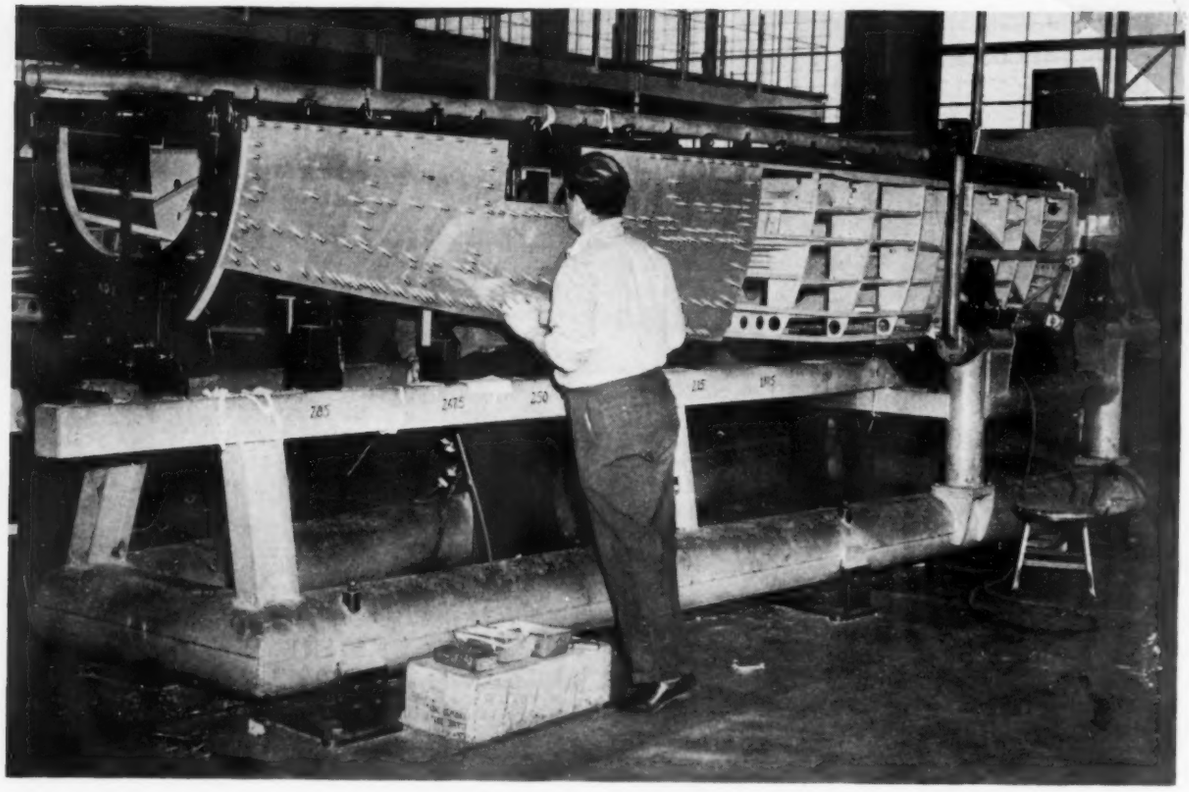
FIGHTER PLANES being built by the Republic Aviation Corporation are divided during manufacture into fuselage and wing groups. The parts of each group constitute a major subassembly—top and bottom halves of the main fuselage, the tail section of the fuselage, and the center, outer left-hand and outer right-hand wing panels. These are built up from minor subassemblies which are so drilled and formed in accurate jigs that they match within close limits during later fabrication. Locating points on all jigs are set by expert toolmakers.

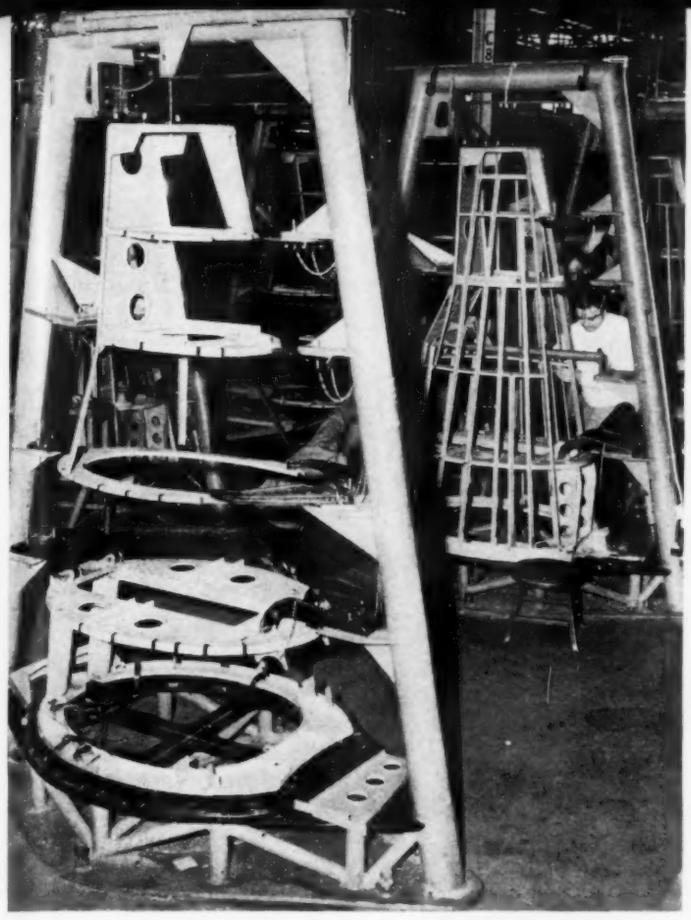
The fuselage of Republic planes is of all-metal

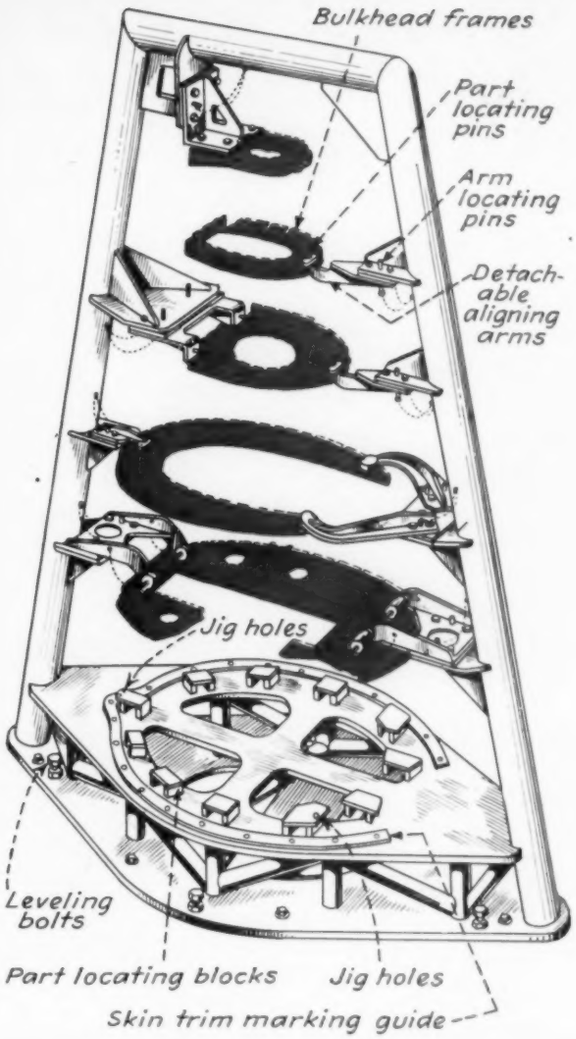
This article has been reviewed and approved by the proper military authorities



The fuselage is built in two halves, split along the horizontal center line. Only bulkhead frames are bolted to the jig members. Stringers and skin are pre-drilled to speed assembly. This construction permits easy access by mechanics for installation of control brackets, wiring, radio and other accessories







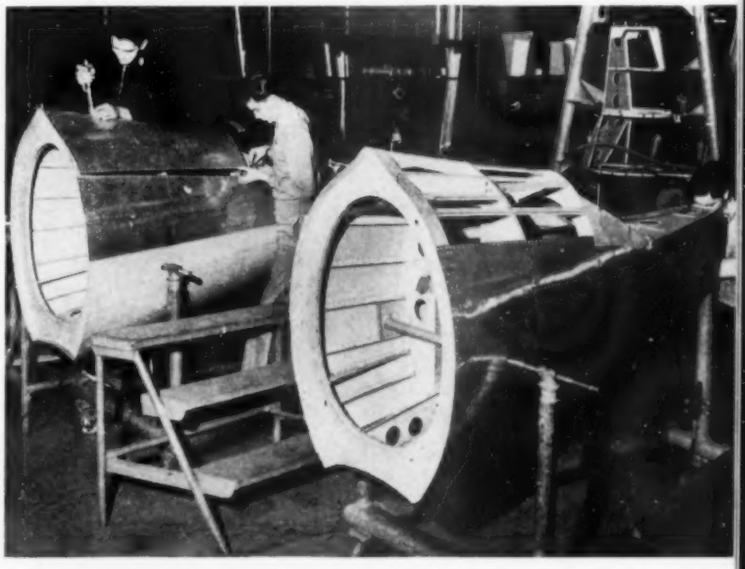
The tail is built in two separate jigs. The first is for locating the tapering bulkhead frames and assembly of pre-drilled stringers. The skeleton is placed in a horizontal jig where the skin is applied. When completed, the tail is spliced to the fuselage

semi-monocoque construction and is approximately circular in cross-section. Essentially, it consists of continuous longitudinal stringers, bulkhead frames, and a stretched skin riveted to the stringers and frames. Engine-mount reactions are carried into the structure by box-like longerons.

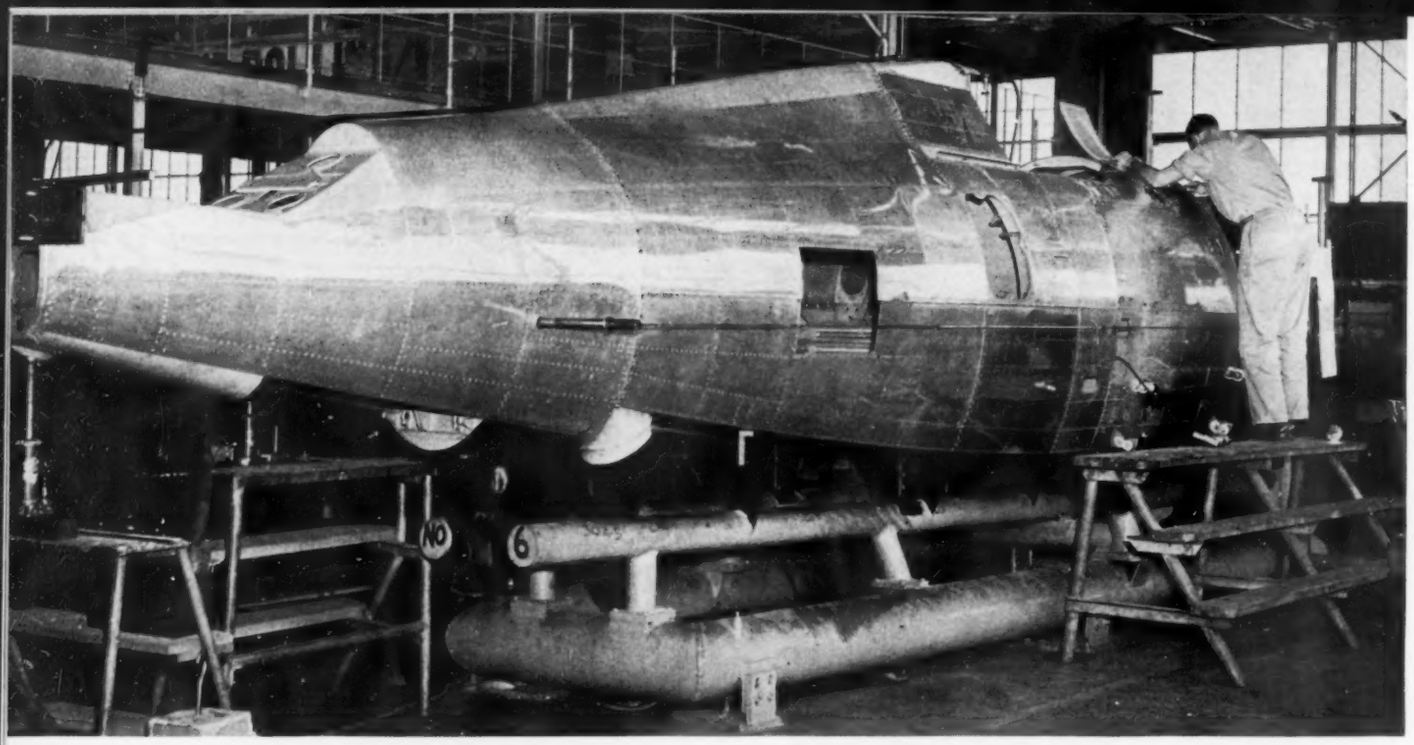
The wing is of full-cantilever design and tapers in plan form and thickness. Main spars with fore-and-aft ribs give the necessary torsional rigidity. It is built of a center panel bolted to the fuselage, which contains fittings and wells for the retractable landing gear, as well as most of the trailing edge flaps. Outer wing panels are spliced to the center panel, and carry the rest of the trailing edge flaps and the ailerons. Fuel tanks are integral parts of the wing. Wing tips are built as a separate subassembly and spliced to the outer panels.

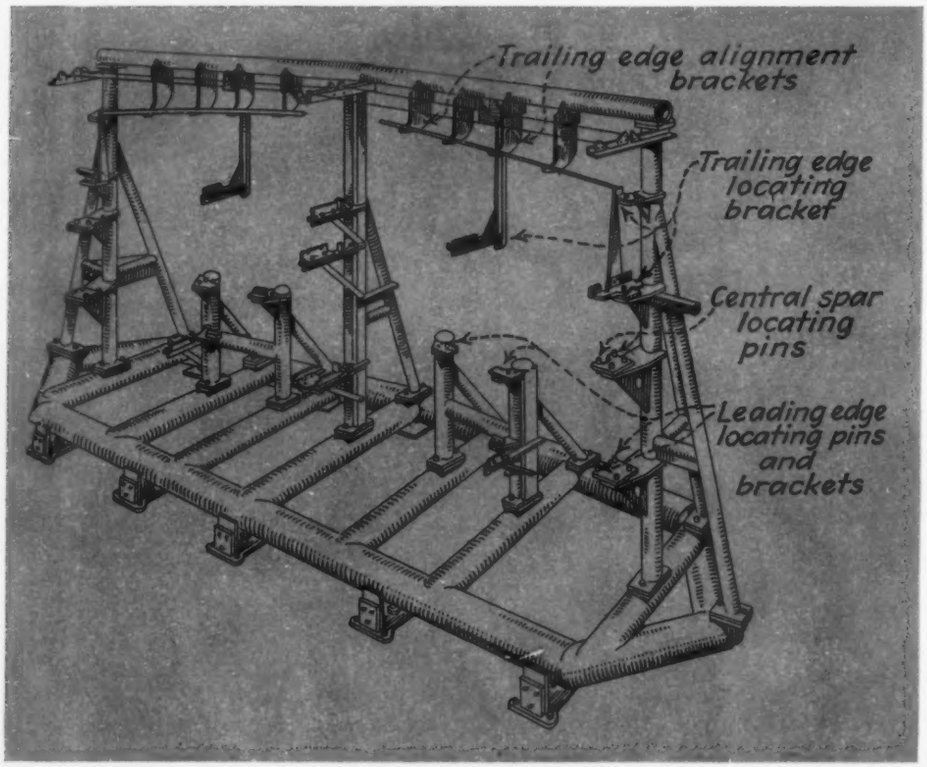
Fuselage Built in Two Sections

The major subassemblies of fuselage and wing sections are finally assembled on rolling jigs which move from station to station on a final assembly line. Here the center wing panel is mounted on a rolling jig. The fuselage, outer wing panels, wing tips, engine assembly, retractable landing gear, tail surfaces, control surfaces, and all accessories are added as the plane goes from station to station on the assembly line.



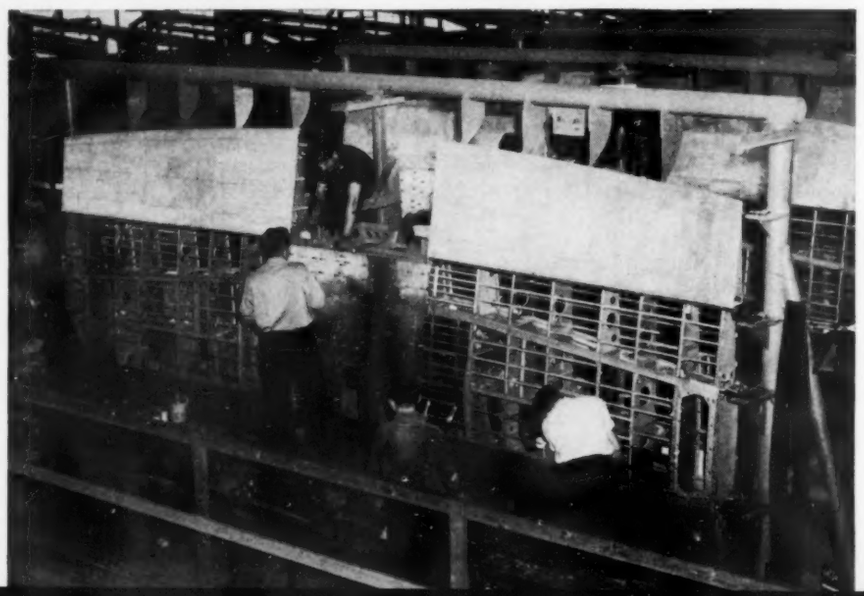
The fuselage is first subassembled into top and bottom halves which are later spliced together. Bulkhead frames, flooring, brackets, stringers and skin are completely drilled before assembly. For assembly of the top and bottom halves of the fuselage, bulkhead frames are bolted to rigid locating points on horizontal members of the jigs, followed by stringers which are




Trailing edge alignment brackets
Trailing edge locating bracket
Central spar locating pins
Leading edge locating pins and brackets

The two halves of the fuselage and tail are spliced together in this jig. The crash protector, turtle deck, canopy track, windshield and engine mount are added before the unit goes to the final assembly line

This jig for the center wing panel has locating points for the main or center spar and leading and trailing edges. The ribs jig themselves to these parts because they were drilled accurately in their subassembly jigs. Stiffeners, brackets, accessories and skin are added to complete the panel



riveted to these frames. The skin, comprised of flat sheets previously sheared and routed to shape and drilled, is finally riveted to the stringers. These assemblies are removed by unbolting the bulkhead frames from the vertical and horizontal legs of the jig. They are taken to a fuselage assembly jig where the two halves are spliced together and the tail section added.

Building the two halves of the fuselage in this manner and later splicing them permits easy access by mechanics for installation of control brackets, electric wiring, flooring, radio parts and other accessories. The skin of the fuselage and tail sections is staggered during subassembly to facilitate splicing and to avoid too great a strain on the ship at the splice point. After splicing, minor subassemblies such as the crash protector, turtle deck, canopy track and windshield are added. In the meantime, the engine is mounted in a tubular frame which attaches to the four longerons in the fuselage section. This assembly and many subassemblies, are sent to the final assembly line. The latter includes stabilizers, elevators and rudder for the tail section; nose cowling, pre-heater, flap rings and flaps, and cowl panels for the power plant section; and miscellaneous parts such as cockpit inclosures, windshield, fairing fillets, landing gear fairing and air ducts.

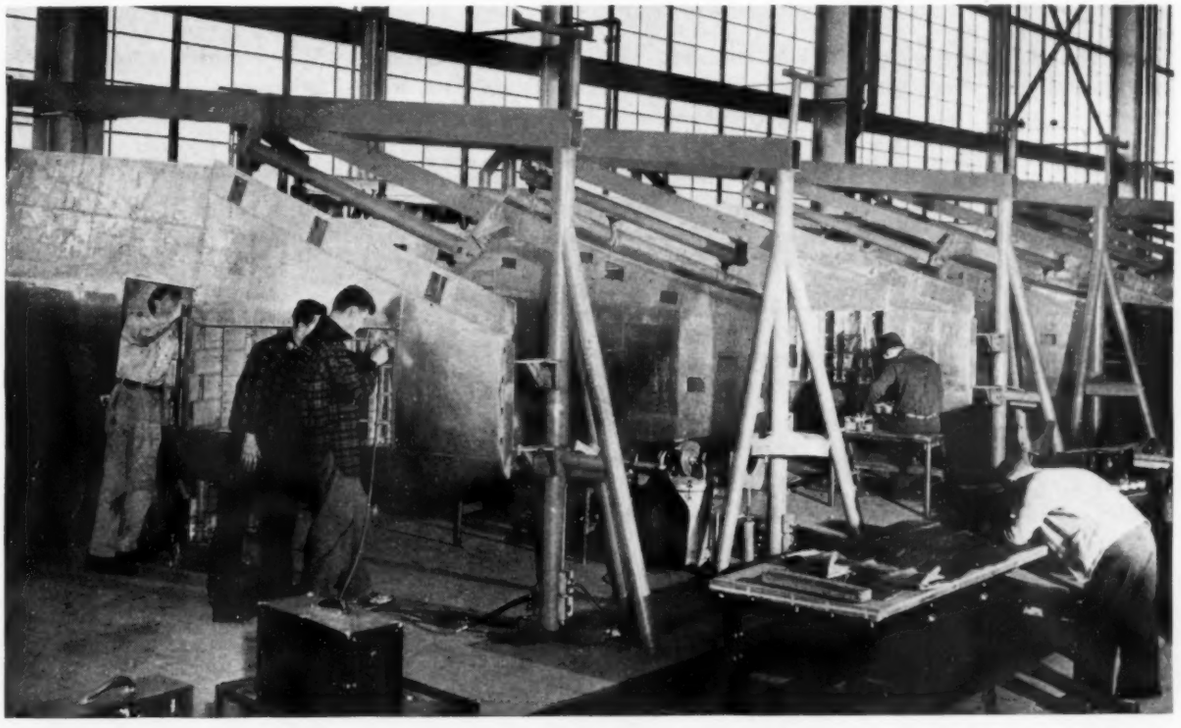
The wing is made up of a center panel that bolts to the fuselage, left- and right-hand outer panels, and left- and right-hand wing tips. Spars, ribs, leading and trailing edges, corrugated sheets, flat sheets for the skin, landing gear and control surface brackets, and miscellaneous accessories arrive at the assembly stations in the wing department completely drilled for further assembly. When completed, the outer panels and wing tips are sent to the assembly line as individual units.

Wing Assembly

The jig for the center panel has locating points for the main center spar and leading and trailing edges. Fore-and-aft ribs are then riveted to the spars and the leading and trailing edges, each rib section jigging itself by virtue of accurately spaced holes drilled during subassembly in jigs designed for that purpose. All necessary stiffeners, brackets and accessories are added before the skin is applied to avoid working in restricted space.

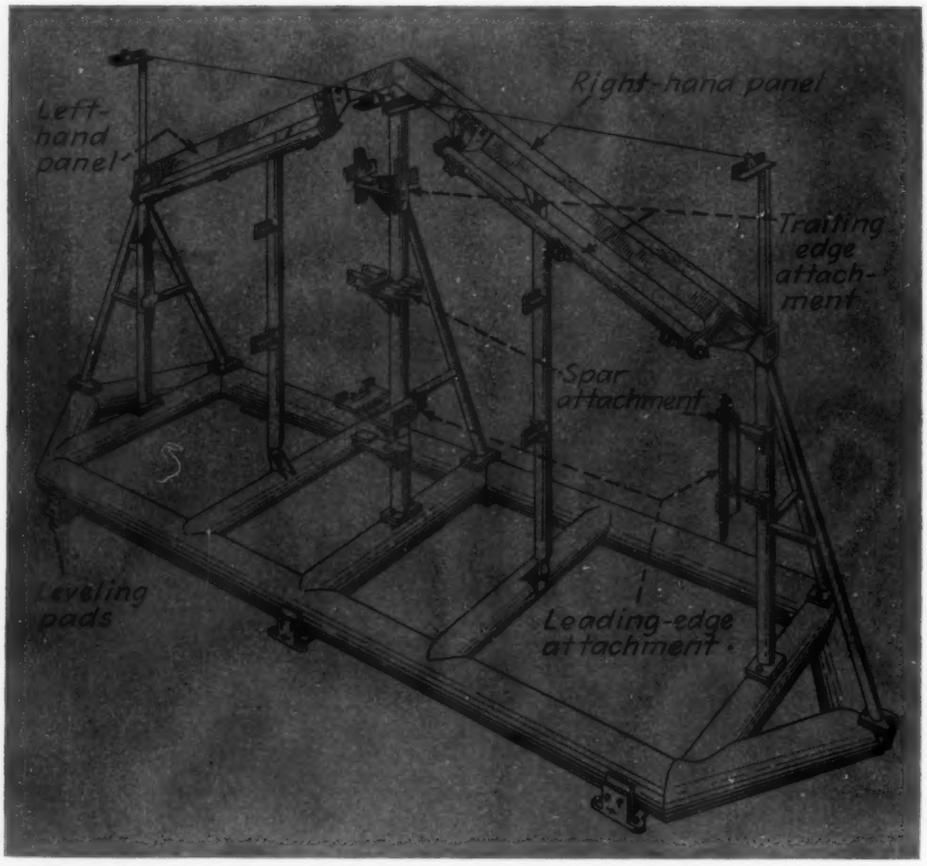
Corrugated sheets and skin sections are riveted to the spars and ribs on top of the panel, while stringers are riveted to the underside. Flush riveting is used, the skin sheets having been dimpled for this purpose.

Each jig for the outer panels of the Republic Lancer, the P-43, is designed for the assembly of one

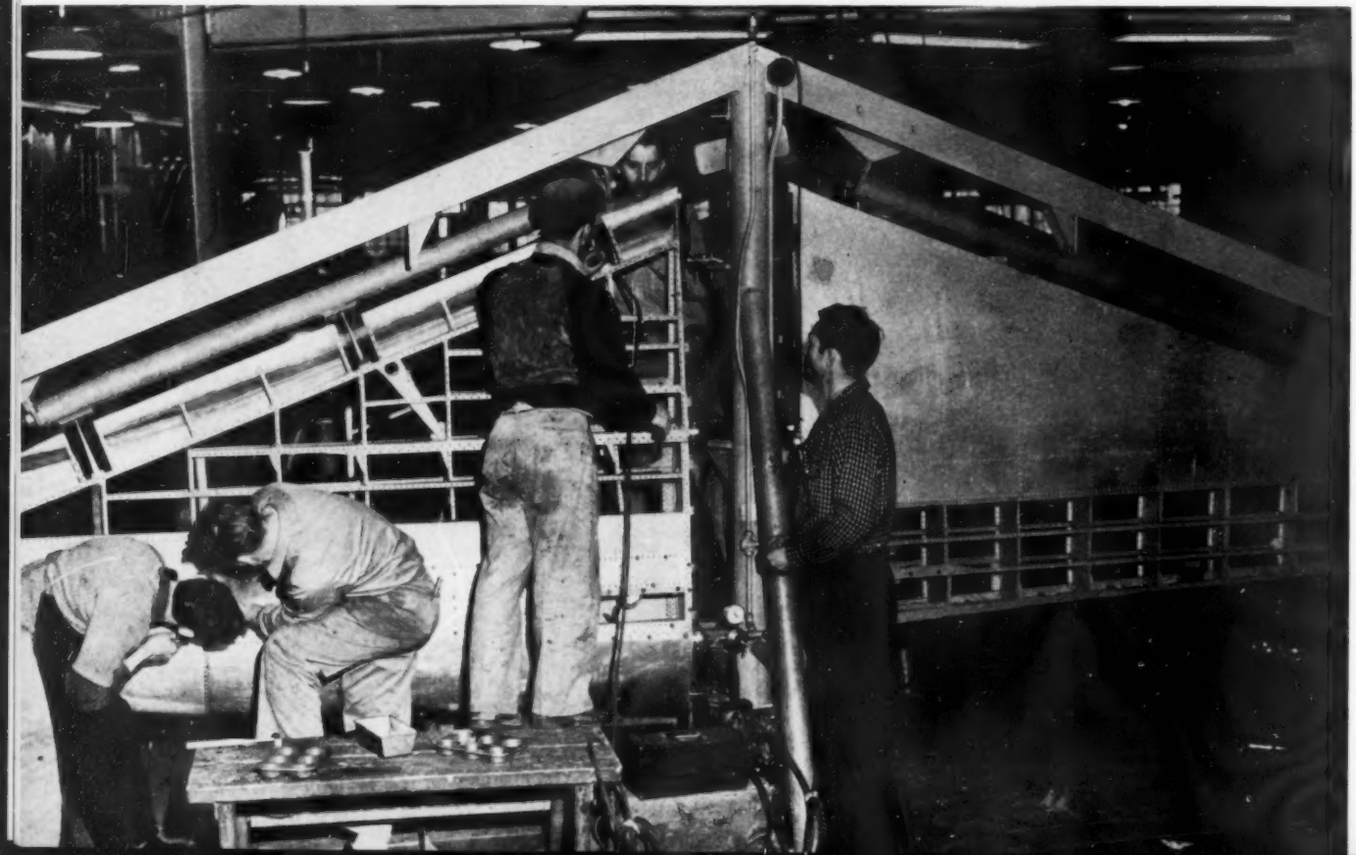


Left- and right-hand outer wing panels for the Republic Thunderbolt are built in separate jigs, each pair being adjacent to each other on the assembly line. Like all other Republic jigs, the heavy tubular bases are covered with wooden platforms

UNLEASHING THE THUNDERBOLT



Left- and right-hand wing panels for the Republic Lancer are built in one jig. Toolmakers use reference sketches such as shown here to build the jig; all dimensions are taken from drawings of the plane parts. Such sketches are prepared for every major plane part



left-hand and one right-hand panel. The wing assumes considerable taper along the trailing edge as soon as it leaves the center panel splice; therefore, the outer panel jig is designed to conform to this shape. Similar to center-panel assembly, spars, leading and trailing edges, ribs, brackets, accessories, corrugated sheets and skin sheets are assembled in order. Each of these parts made previously on subassembly jigs are drilled accurately to jigs themselves as assembly of the outer panels proceeds. A minimum number of non-removable fastening points is required both for the outer and center panels, which facilitates removal of finished assemblies from the jigs, and assures identical assemblies.

The outer wing panels for the Thunderbolt are assembled in a similar manner, except there is a separate jig for the each outer panel.

The wing tips are jig assembled from ribs, stiffeners and flat sheets. Tips are spliced to the outer panel just prior to movement to the assembly line.

Aside from component parts of major subassemblies, jigs are used to make canopies, turtle decks, air scoops, control surfaces, landing gear fillets, engine mounts, cowling parts, fire walls, instrument panels and covers. Also oil tanks, brackets of all kinds, seats, ammunition boxes and other accessories. Material for these parts may be press formed, stretched or hand-formed, and otherwise worked, following general sheet-metal practice for plane parts.

Republic jigs are made from standard pipe sizes, a large proportion of which is reclaimed material. The sections are flame cut and arc welded. Bottles for air take-offs and electrical conduit are integral with the structures

Jigs Are Precision Tools

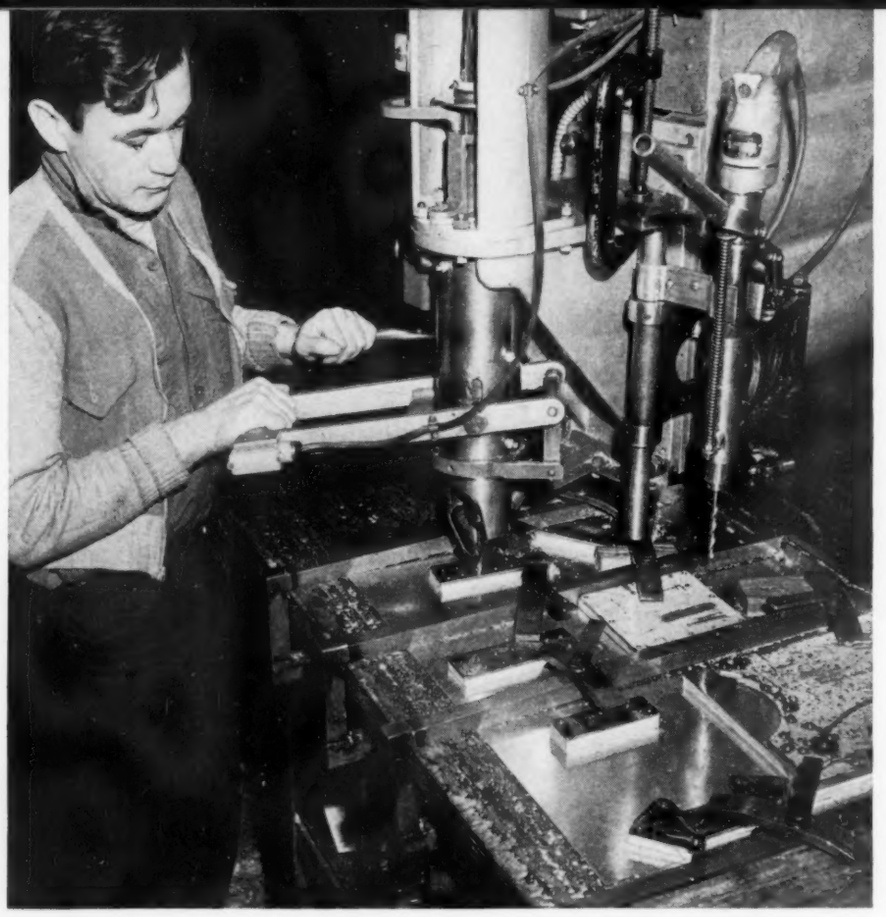
All jigs used for minor and major subassemblies are built and maintained by expert toolmakers. There are two important factors in jig construction. One is the fast and flexible combination of gas cutting and arc welding. The second is the extensive use of tubular steel members for structural parts of all jigs. Some of the advantages gained are worth noting. Inherently the round tube member has a high strength-weight ratio compared to all other sections; also high torsional resistance and high column strength in compression. Tubing is easily assembled by direct connection. The resulting structures provide the greatest rigidity for the weight of steel used, they are trim and neat, they are not cluttered up with connecting members, and they provide maximum accessibility to the work. Rigidity is extremely important because locating points on the jigs must continue to be in the same position with relation to one another throughout the life of the jig.

The sections mostly used by Republic are standard pipe sizes, and since they are used for framework only, it is not necessary to use new material. A good supply of used pipe is kept in stock. Pipe from discarded jigs can be salvaged for further use.

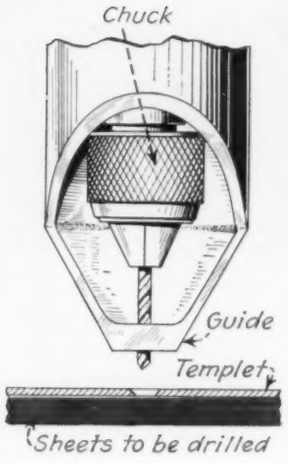
All the jigs consists essentially of rigid frames to which are welded the necessary brackets and pads that serve as holding and locating points. They are so designed that they do not have to be taken apart to remove completed work. The only parts removed are bolts, dowels or clamps at holding points. For each type of subassembly, such as a fuselage section, wing panels, rudder, ailerons and fins, there is a corresponding type of jig, and for each type of jig the tool-shop foreman is furnished with a reference sketch. Three of these sketches are illustrated—one for the center wing panel, one for the outer wing panels, and one for the tail section.

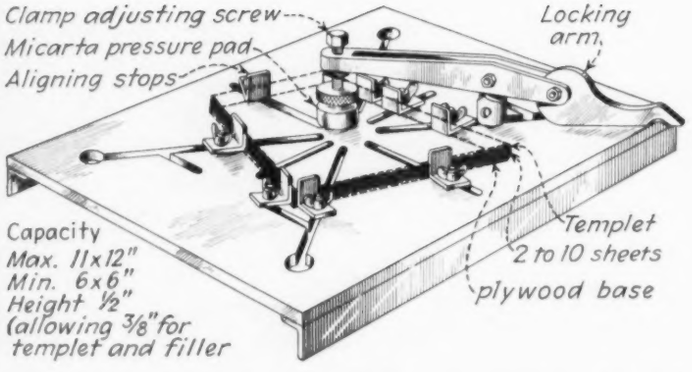
To illustrate the importance of these reference sketches, suppose that an order is received for a number of planes in which two major dimensions are changed a few inches from models previously built. The drafting-room is not called upon for dimensioned drawings of the numerous new jigs that will be needed. The tool-shop foremen will consult the reference sketches of the jigs for his general designs, and then secure dimensions from the detail drawings of the plane parts.

Experience dictates the selection of the pipe size for each jig member. In case of doubt, the larger size is indicated. There is no advantage in calculating design



Templets are clamped over stacks of routed sheets and then drilled. Although Farnham stack drillers handle all large sheets, an auxiliary drill is clamped to the Farnham drill arm to speed the work when a number of small templet groups are on the table





Many of the applied shapes are so irregular that adjustable nests must be used for drilling the sheets. After aligning stops are adjusted, the sheets and drill templet are stacked on the plywood base. A swiveling center clamp holds the assembly for drilling

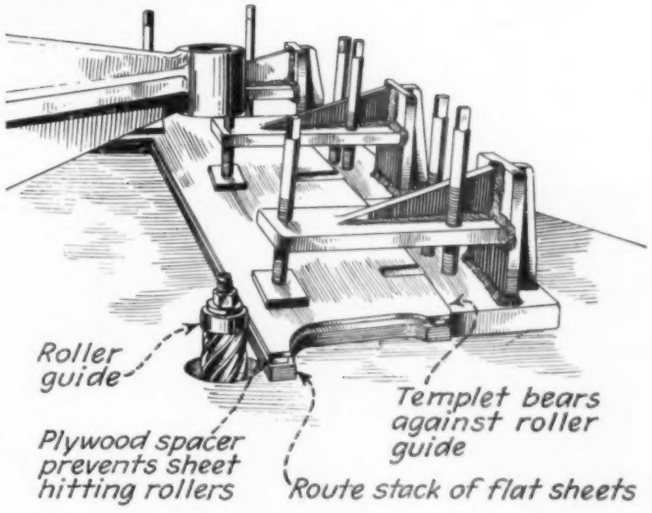
stresses, because with such inexpensive material the additional rigidity achieved in the use of heavy sections is not a luxury. Similar discretion is allowed in the selection of stock for brackets, bracing fins and other parts which are structural rather than functional in character.

Construction starts with the base or float, so-called because of its shape and appearance. The pipe is cut with hand torches, welded together on the floor and checked for size. The smaller tube members are then cut and welded to this base. When the frame is complete it is checked for rigidity, and for position of brackets and subassembly locating points. The whole structure is required to be reasonably square and well aligned, but the tolerances are not extreme. For example, the reference sketches of the wing-panel jigs show that at each end of these jigs there are masts with a steel wire stretched between them at the top. This wire is the center reference line of the jig, and when in use a plumb bob is frequently suspended from it. The first welding crew is not concerned with the accurate location of the center line. That is taken care of when locating points and supports for it are attached by expert toolmakers.

Steel angle sections are welded to the float to provide a good bearing on the floor. An adjusting bolt at each of these feet assists in leveling the base of the jig; then the bolts on the slotted side plates are tightened and the tension on the adjusting bolt is relieved so that it will not have to carry the full weight.

UNLEASHING THE THUNDERBOLT

Stacks of flat sheets are routed to shape using a high-speed cutter. The sheets are clamped beneath a plywood spacer and the templet. The latter bears against a guide roller bolted to the top of the cutter spindle


Roller guide
Plywood spacer prevents sheet hitting rollers
Templet bears against roller guide
Route stack of flat sheets

When the frame has been approved structurally, an experienced crew takes over the job of attaching the locating points, holding points and other work support members. This is a precision job. The allowable working tolerance in assembly of the plane parts is 0.010 in. In order to give the assembly departments the benefit of at least half of that amount, the theoretical dimension tolerance of critical reference lines in the jig is 0.005 in. Standard practice is to keep as close to zero as possible.

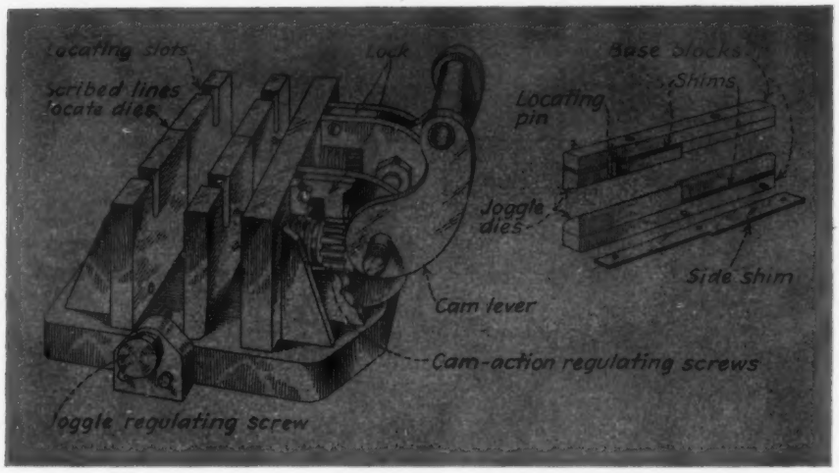
The mechanics who attach these important parts to the tubular frame fit every piece into place with transit control. Once the transit is set in place it is not disturbed until the jig is complete. At this stage welding has the very great advantage of permitting the attachment of all types of bearing plates in any required position. Some of the very large jigs with the float type of base are moved to their position in the factory before completion. The base is leveled, the jig is checked again with the transit and the final fitting is done under transit control. Then it is ready to go to work.

On some of the jigs there are pads or brackets which need to be removable, but they are so finely adjusted that they must be safeguarded against dismantling by any except authorized persons. A small tack weld does the trick. A broken tack weld is evidence of unauthorized tampering, and automatically indicates a recheck of the jig reference points.

Further to safeguard the precision of the jig, important areas, such as locating and attaching points, are coated with a dark blue paint, which contrasts sharply with the gray paint used on structural areas. The blue-painted areas are treated with respect and assembly men are trained not to hammer or deface them in any manner.

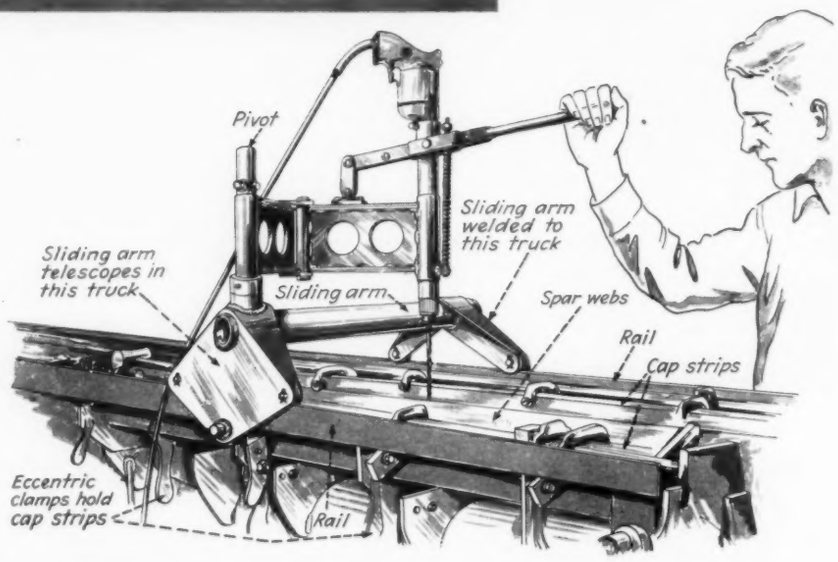
The illustrations of the Republic jigs reveal several useful features. The round sections of the frame do not provide shelves or pockets where small tools can be misplaced or mislaid. The large jigs are so open that several men can work simultaneously on a single assembly. Bottles for air take-offs for air tools, electrical conduit and outlets are integral with the structure.

Outstanding features of the jigs are the small number of fastening points required, and the use of bolts



Republic uses this design of joggle die and holder for offsetting angles, channels and other structural shapes. When mounted in the press, the structural shapes are held securely in position for joggling. This prevents wrinkling the part adjacent to the off-set

Machined cap strips are held by eccentric clamps in the spar jigs, the locating brackets of which are contoured to match the shape of the cap strips. Web plates and angles are located by pre-drilled holes in all parts, the assembly being held by a top jig plate. Final drilling and reaming of the assembly is done with a portable telescoping drill that runs on rails paralleling the cap strips



and dowels to hold parts during assembly. But since assembly men have only to handle these bolts and dowels to remove a completed assembly from its jig, all assemblies from each jig are identical. This being characteristic of all jigs, progressive assembly of both minor or major assemblies proceed in all departments at maximum speed.

Accuracy of Subassemblies

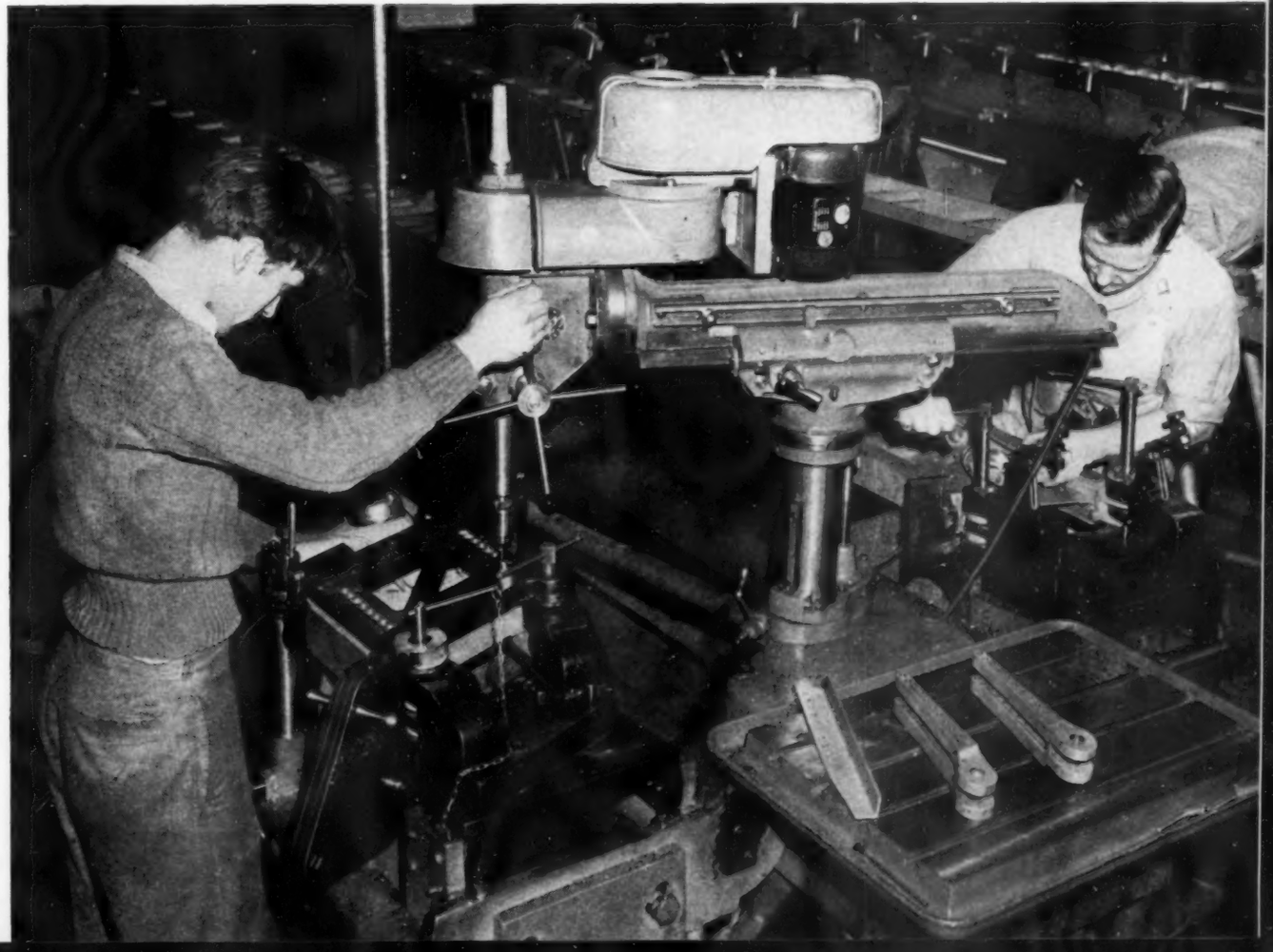
The success of the assembly method used by the Republic Aviation Corporation depends on the accuracy of subassembled parts. This accuracy is maintained from the moment flat stock and extruded structural shapes for minor subassemblies are obtained from the stockroom. Flat stock for ribs, spars, bulkhead frames, flooring, wing parts, and skin are first sheared to approximate shape preparatory to routing and blanking. After routing, the blanks may be used as is and sent to stack drills either for complete drilling or drilling of several holes used later in punch or hydraulic presses for locating points. Many of the blanks are formed on dies and drop hammers, in punch presses, in hand forming dies, on planishing hammers, or on hydraulic presses with rubber-forming pads.

Templets are used for contour routing and as drill jigs. They are clamped over six to ten flat sheets. Preparatory to routing, preliminary fastening holes are drilled, bolts inserted and the clamps removed. The sheets are rough cut to shape on metal band saws, the blade following the contour of the templet. Final contouring is done by vertical millers or routers, the cutter being guided by a roller which bears against the side of the templet. Additional holes are drilled for the preliminary fastening of parts during first assembly operations. Some sheets are sent to assembly jigs without further work. Other sheets are drilled completely, flanged, pressed, stamped, and otherwise prepared for later assemblies.

Extruded angles and channels are cut to desired length and drilled accurately. When required, they are rolled and drawn to match the curved lines of the ship, the contour being held to close limits by templets. Offsets are made on joggle presses, or with joggle dies used in regular bending brakes.

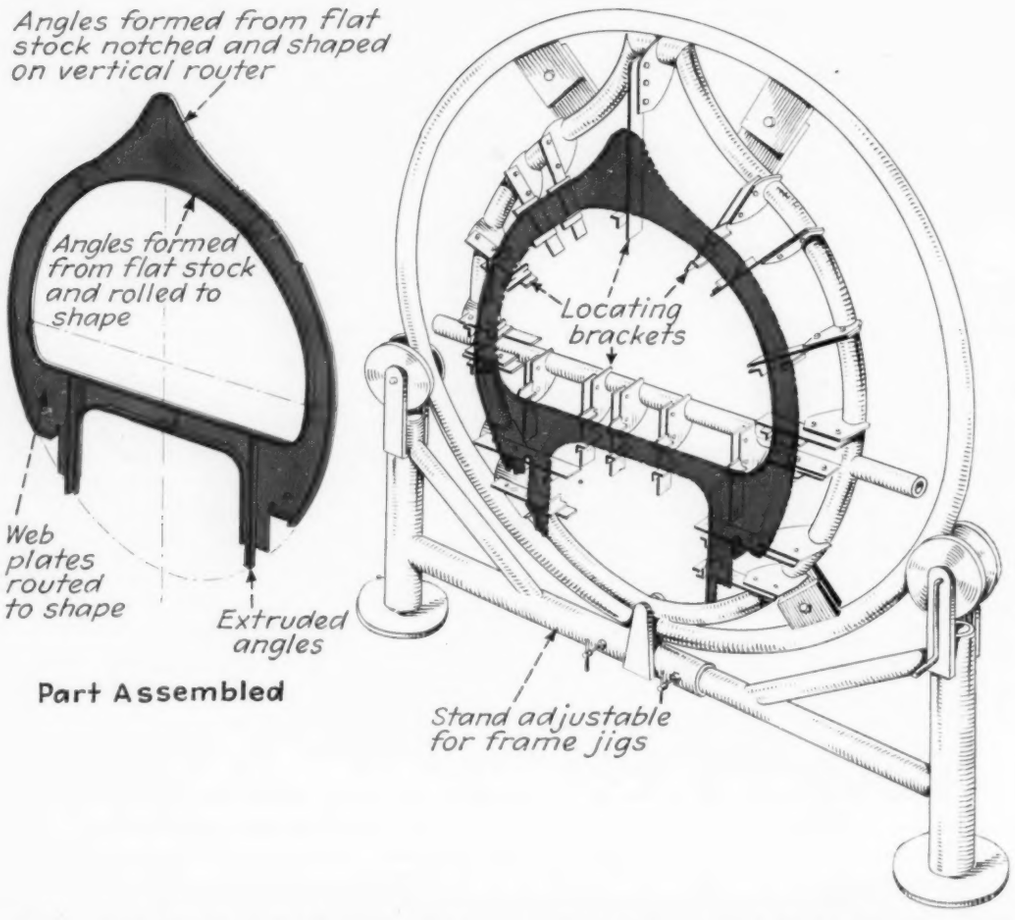
Some of the plane parts are so irregular that it is

The inboard section of spars in the outer wing panel has forged hinges for splicing to the center panel. The hinges are predrilled and located on each spar by a drill jig fitted with hardened steel bushings which guide the drill through the hinges and spar. For this operation, a radial drill is placed at each pair of spar jigs



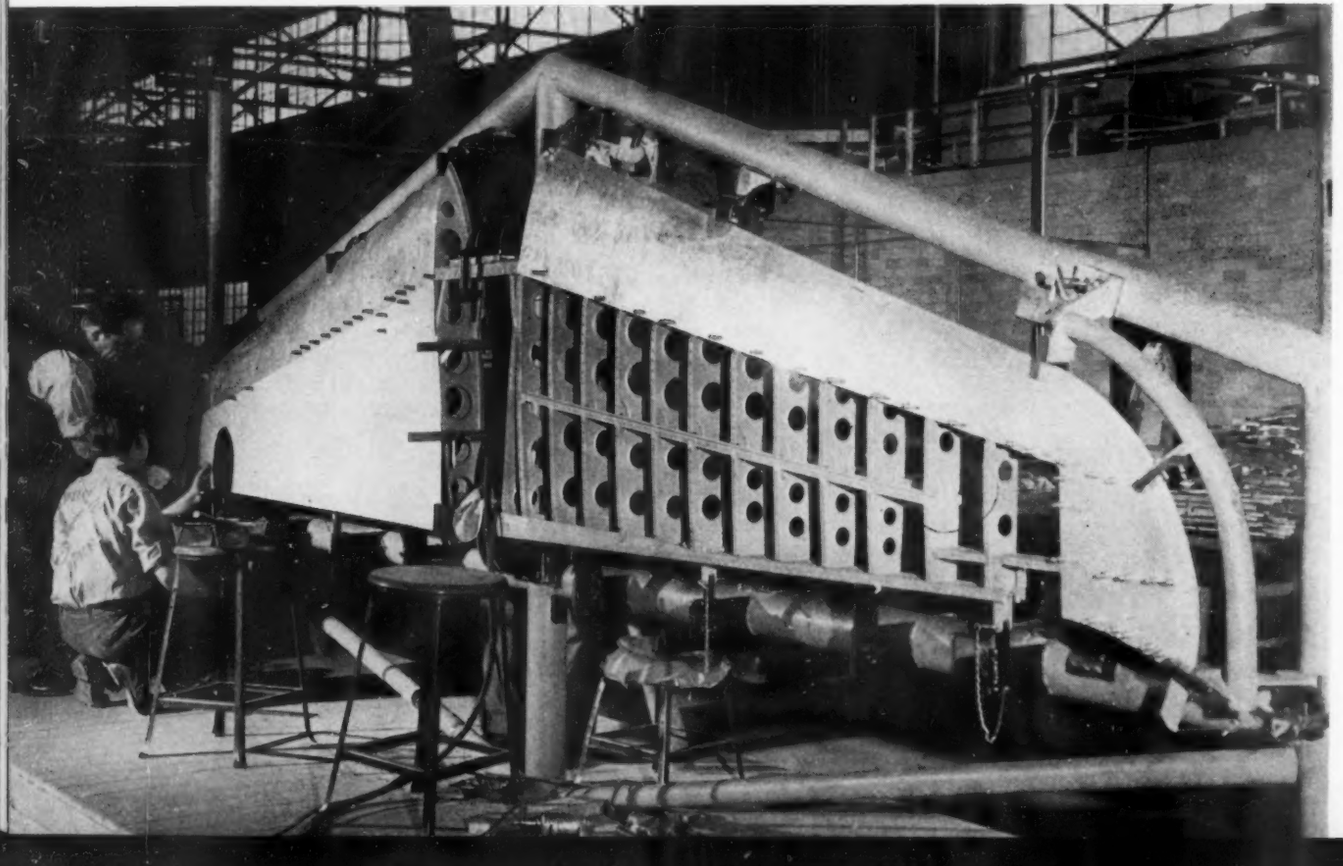
UNLEASHING THE THUNDERBOLT

Bulkhead frames are assembled in jigs of tubular construction with locating plates and brackets welded in position. The jigs are mounted on tubular stands fitted with rollers so they can be rotated to facilitate assembly operations. The stands are adjustable to take jigs of various diameters


Angles formed from flat stock notched and shaped on vertical router
Angles formed from flat stock and rolled to shape
Web plates routed to shape
Extruded angles
Locating brackets
Stand adjustable for frame jigs

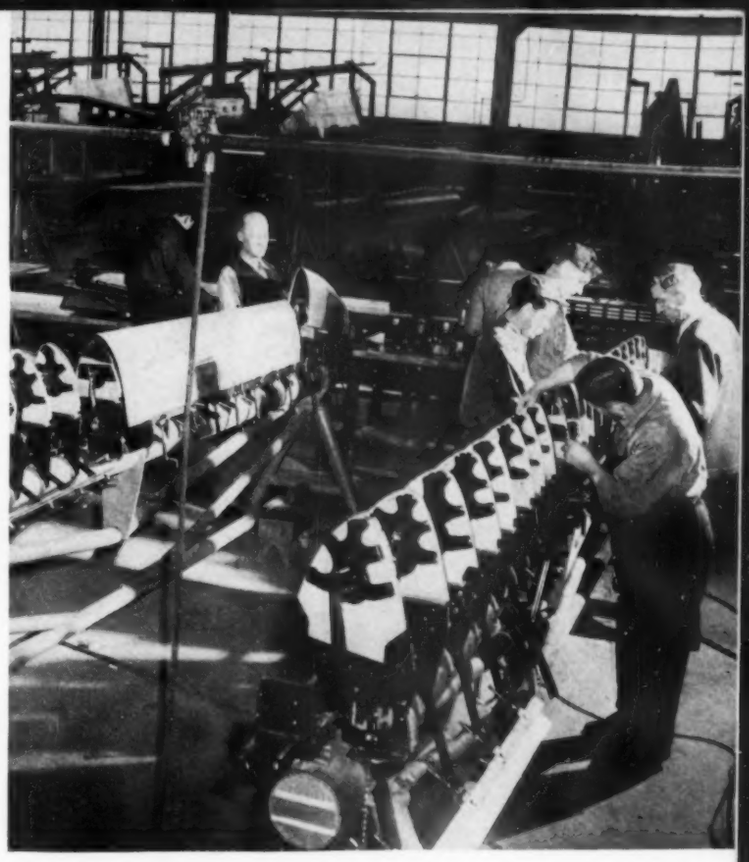
Part Assembled

Rudders are built in pairs in this jig. Rudder control hinges on the outer spar are bolted to the horizontal jig member, followed by the ribs and intermediate spar which are predrilled to jig themselves during assembly. The subassembled outer edge is held in the jig by contoured locating pads

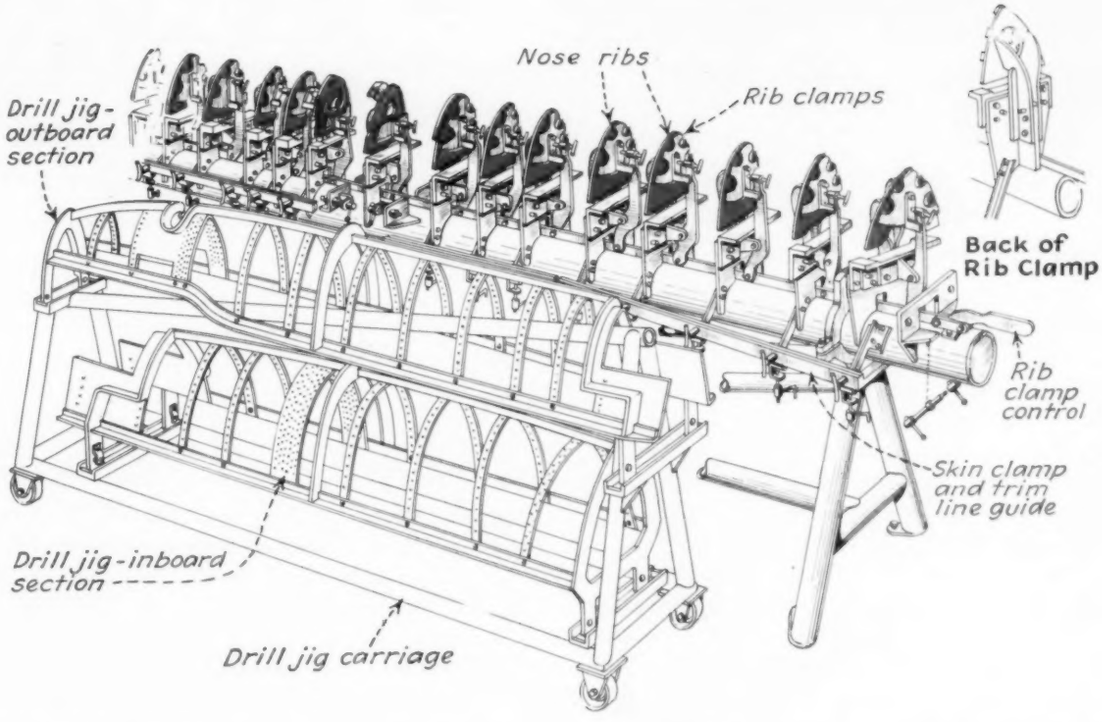


necessary to shape the part on hand forming blocks or pianishing hammers. These parts are usually so complicated that it is necessary to complete the hand forming in the assembly fixture, where final trimming, welding and riveting is done. One such part is the shroud. Here several sheets which make up the shroud is hand formed, placed on the jig for finish-forming, trimming and cutting out the doors. Flanges are placed on the shrouds in this fixture, and rivet or bolted preparatory to spot welding.

The technique of jig assembly is best exemplified by methods for making spars, bulkhead rings, leading edges, rudders, fins, and ailerons. Jigs for these parts are illustrated. Take the spars, which run

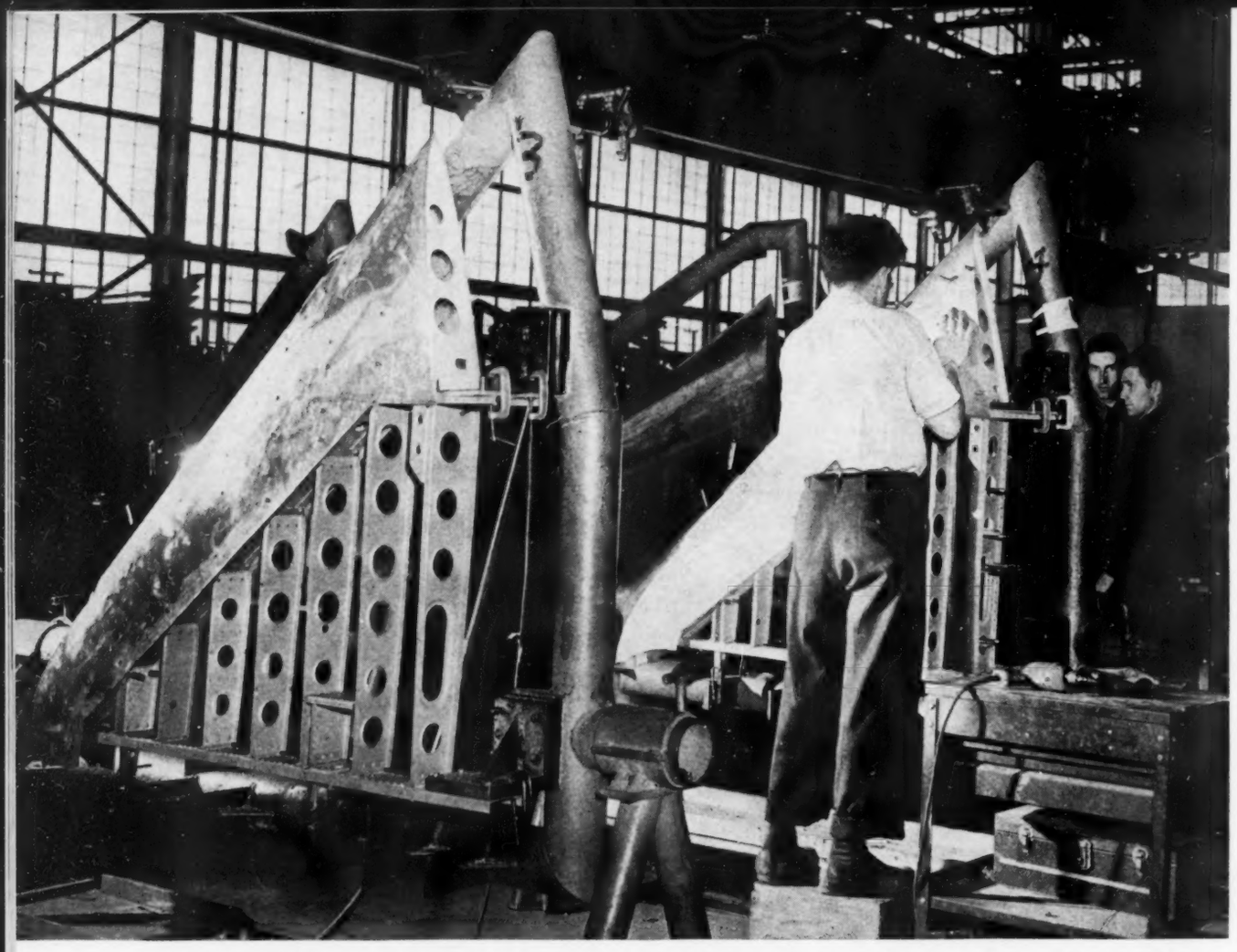


Press-formed nose ribs are located precisely by finger-shaped brackets in this leading edge jig. The brackets are first drawn up with thumb screws and then tightened by an interlocking lever system. Predrilled skin is stretched over the ribs and clamped on the trim line. The ribs are then drilled and the skin riveted



longitudinally through each wing. Cap strips for these spars are milled from extruded sections on Farnham milling machines. The milling are cutters mounted on a head which simultaneously rotates and moves vertically as it runs horizontally on tracks; thus, in one operation the cap strips are machined to match the contour of the wing and, by varying the thicknesses of the flange, to maintain uniform stress conditions throughout the length of the wing. (*AM* Vol. 85, page 1133.)

The machined cap strips are placed in the spar jig against brackets shaped to match the contour of machined sections. They are held in the jig by eccentric clamps. Web plates and angles, previously drilled or perforated, are added and clamped to the cap strips by a drill jig plate which is held in proper relation by clamps on the main jig. With the cap strips, web plates and angles thus held by the fixture proper and jig plates, the entire assembly is drilled by a drill running on rails which parallel the contour



Many Republic jigs, including the one for fin assembly shown here, are designed to turn on trunions, thereby bringing the assembly into the best possible position for drilling, reaming and riveting

of the spar jig. This drill is designed to telescope within itself, so that it can run along the rails without interference regardless of the width of the spar which usually is narrow at the ends and wide at the center.

After the web plate, angles and cap strips are drilled, spring fasteners are added to hold the assembly. Drill chips are removed and the parts bolted together. The spar is removed from the jig and sent to a riveting machine for final assembly.

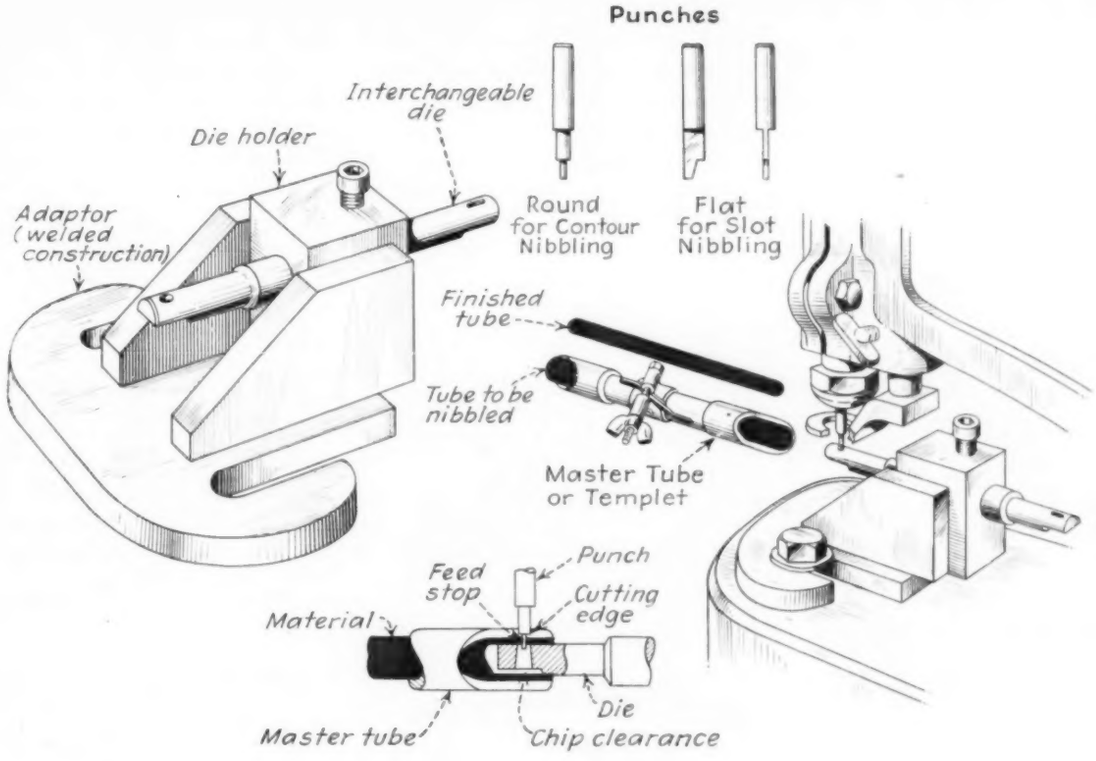
Bulkhead frames are built up from web sheets, placed between flanges and stiffeners. The flanges, semi-circular in shape and conforming to the ship's line, are rolled or press formed in sections of various lengths. These are assembled around the jig and clamped in place. The web sections and stiffeners are temporarily bolted in position through pick-up holes jig drilled previously. Complete drilling is done in the jig through top flanges and stiffeners, holes in which were drilled before they were shaped. Preparatory to machine riveting the frame assembly, all holes are drilled, spring fasteners are inserted, chips are removed, and spot rivets or bolts applied.

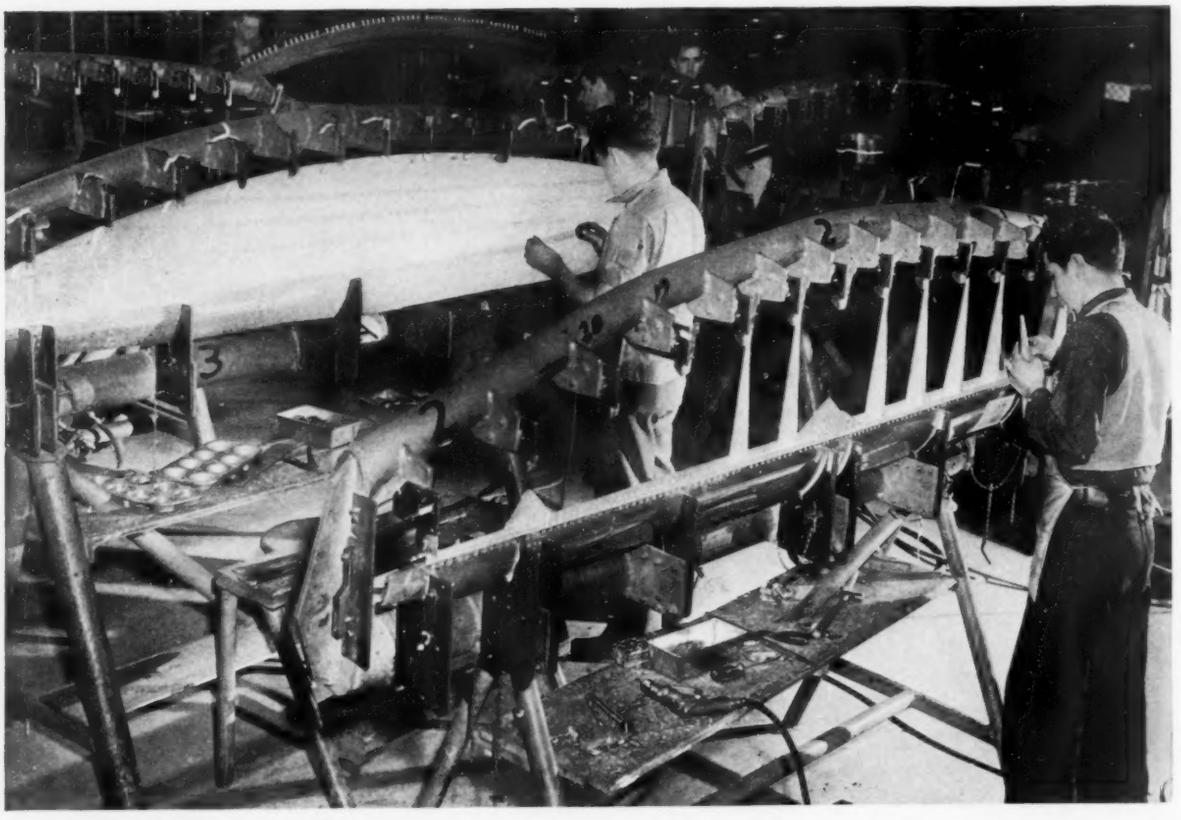
Leading edges are assembled by placing nose ribs in a jig, the locating brackets of which are shaped to match the outline of the ribs. The bracket for each nose rib is pulled up tight by a thumb screw. When all the brackets are pulled up, they are tightened further by an interlocking lever arrangement operated from one end of the jig by an eccentric. This is shown in the illustration of the leading edge jig. The skin is stretched over the ribs and securely fastened by a clamping plate running the length of the jig. When the skin is in place, a "bird cage" drill jig is placed over it. Holes are then drilled and dimpled through the skin and rib angles. The "bird cage" is removed, the skin loosened at one end, and the skin riveted to the nose ribs. This assembly is then riveted to the leading edge spar.

Trailing edges are jig drilled in the same manner as the leading edge. These jigs are also made of horizontal steel tubes supported by triangular-shaped tubular legs. Locating pads are spaced to hold rib attaching angles, as well as aileron and flap brackets, all of which are riveted to the spar. Ribs, ties and stringers are added in order and drilled and riveted as they are assembled. The skin is drilled, removed for dimpling, replaced and held by spring fasteners, and finally riveted.

The foregoing description of jig assembled parts applied in general to assembly of flaps, rudders, ail-

Struts and tubes for engine mounts, made from tubular sections, are nibbled to form joints of welded assemblies. The tube to be nibbled is inserted and clamped in the master tube or templet, which is rotated by hand on the die under the punch. This decreases by 50 percent the time needed to make strut members

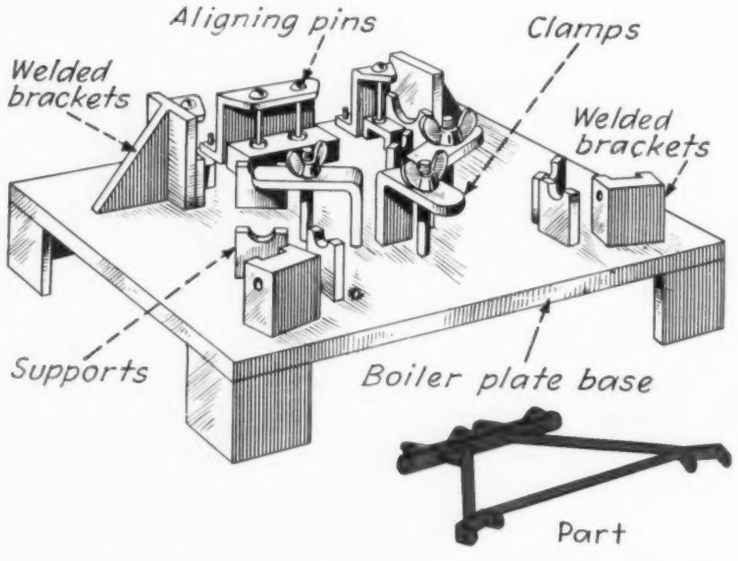




This aileron jig shows the technique of Republic's assembly practice. Here the leading edge rests in contoured pads on the horizontal bar, while ribs are aligned by bolting to precisely located jig points

erons and wing tips, illustrations of which are shown. In every instance, the jigs are designed to assure exact duplication of subassemblies.

Various struts and engine mounts for Republic planes are made from tubular sections. These struts and mounts are welded construction, and the tube joints must be cut to fit adjacent tubular sections at a variety of angles. The tubing was cut originally by hand, contour saws and oxyacetylene flame, and finally filed and hand worked to shape. This method has been superseded by nibbling. The tube to be nibbled is inserted in a master tube or templet the ends of which are contoured to the required shape of the part. The assembly is inserted over a nibbling die with the templet edge bearing against the punch. The high-speed ram makes it possible to nibble both ends of a strut in a few minutes. This procedure has decreased by 50 percent the time previously required for shaping tubular sections for struts and engine mounts.



This is a typical welding fixture used by Republic. Forgings, tubing and plate are clamped in position, the angular joints of the tubular sections having been nibbled as shown in another illustration

Draft in Inches for Die Clearance Angles—I

BY W. J. WOODWORTH AND P. T. WOODWORTH

Depth	15′	30′	1°	1°30′	2°	2°30′	3°	3°30′
1/64	.00007	.00014	.00027	.00041	.00055	.00068	.00082	.00096
1/32	.00014	.00027	.00054	.00082	.00109	.00136	.00164	.00191
3/64	.00020	.00041	.00081	.00123	.00164	.00204	.00246	.00287
1/16	.00027	.00054	.00109	.00164	.00218	.00273	.00327	.00382
5/64	.00034	.00068	.00135	.00205	.00273	.00340	.00410	.00478
3/32	.00041	.00081	.00163	.00246	.00327	.00408	.00491	.00573
7/64	.00048	.00095	.00189	.00287	.00382	.00476	.00574	.00669
1/8	.00055	.00109	.00218	.00327	.00436	.00546	.00655	.00764
9/64	.00061	.00122	.00243	.00369	.00491	.00612	.00736	.00860
5/32	.00068	.00136	.00272	.00400	.00545	.00681	.00818	.00955
11/64	.00075	.00149	.00297	.00451	.00600	.00748	.00902	.01051
3/16	.00082	.00163	.00327	.00491	.00654	.00819	.00982	.01141
13/64	.00088	.00176	.00351	.00533	.00709	.00884	.01066	.01242
7/32	.00096	.00190	.00381	.00564	.00763	.00954	.01145	.01337
15/64	.00102	.00203	.00405	.00615	.00818	.01023	.01230	.01433
1/4	.00110	.00218	.00436	.00654	.00873	.01092	.01310	.01529
17/64	.00116	.00230	.00459	.00697	.00927	.01159	.01394	.01624
9/32	.00123	.00244	.00490	.00728	.00981	.01227	.01472	.01719
19/64	.00129	.00257	.00513	.00779	.01036	.01296	.01558	.01815
5/16	.00137	.00272	.00545	.00818	.01090	.01365	.01637	.01910
21/64	.00143	.00284	.00564	.00851	.01145	.01428	.01732	.02006
11/32	.00150	.00298	.00599	.00892	.01199	.01500	.01799	.02101
23/64	.00156	.00311	.00621	.00933	.01254	.01564	.01886	.02197
3/8	.00164	.00327	.00654	.00981	.01309	.01638	.01965	.02293
25/64	.00170	.00338	.00675	.01015	.01363	.01700	.02050	.02388
13/32	.00177	.00352	.00708	.01056	.01417	.01773	.02126	.02483
27/64	.00184	.00365	.00729	.01097	.01472	.01836	.02214	.02579
7/16	.00191	.00381	.00763	.01145	.01526	.01911	.02292	.02674
29/64	.00197	.00392	.00783	.01179	.01581	.01972	.02378	.02770
15/32	.00205	.00406	.00817	.01220	.01635	.02046	.02453	.02865
31/64	.00211	.00419	.00837	.01261	.01690	.02108	.02542	.02961
1/2	.00219	.00436	.00872	.01309	.01746	.02183	.02620	.03058
33/64	.00224	.00446	.00891	.01343	.01799	.02244	.02706	.03152
17/32	.00232	.00460	.00926	.01384	.01853	.02319	.02780	.03247
35/64	.00238	.00473	.00945	.01425	.01908	.02380	.02870	.03343
9/16	.00246	.00490	.00981	.01472	.01962	.02457	.02947	.03438
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19/32	.00259	.00514	.01035	.01548	.02071	.02596	.03107	.03629
39/64	.00265	.00527	.01053	.01589	.02126	.02652	.03198	.03720
5/8	.00273	.00545	.01090	.01635	.02182	.02730	.03275	.03822
41/64	.00279	.00554	.01107	.01671	.02235	.02788	.03362	.03916
21/32	.00287	.00568	.01144	.01712	.02289	.02865	.03434	.04011
43/64	.00292	.00581	.01161	.01753	.02344	.02924	.03526	.04107
11/16	.00301	.00599	.01199	.01799	.02398	.03003	.03602	.04202
45/64	.00306	.00608	.01215	.01835	.02453	.03060	.03690	.04298
23/32	.00314	.00622	.01253	.01876	.02507	.03138	.03761	.04393
47/64	.00320	.00635	.01269	.01917	.02562	.03196	.03854	.04489
3/4	.00329	.00644	.01308	.01963	.02612	.03275	.03930	.04597
49/64	.00333	.00662	.01323	.01999	.02671	.03332	.04018	.04680
25/32	.00341	.00676	.01362	.02030	.02725	.03411	.04088	.04775
51/64	.00347	.00689	.01379	.02081	.02780	.03468	.04182	.04871
13/16	.00356	.00708	.01417	.02126	.02834	.03549	.04257	.04966
53/64	.00360	.00716	.01431	.02163	.02889	.03604	.04346	.05062
27/32	.00369	.00730	.01471	.02194	.02943	.03684	.04415	.05157
55/64	.00374	.00743	.01485	.02245	.02998	.03740	.04510	.05253
7/8	.00383	.00763	.01526	.02289	.03055	.03822	.04585	.05351
57/64	.00388	.00776	.01539	.02327	.03107	.03876	.04674	.05444
29/32	.00396	.00784	.01580	.02358	.03161	.03957	.04742	.05539
59/64	.00407	.00797	.01593	.02409	.03216	.04012	.04838	.05635
15/16	.00410	.00817	.01635	.02453	.03270	.04095	.04912	.05730
61/64	.00414	.00824	.01647	.02491	.03325	.04148	.05002	.05826
31/32	.00423	.00838	.01689	.02522	.03379	.04230	05069	.05921
63/64	.00428	.00851	.01701	.02573	.03434	.04284	05166	.06018
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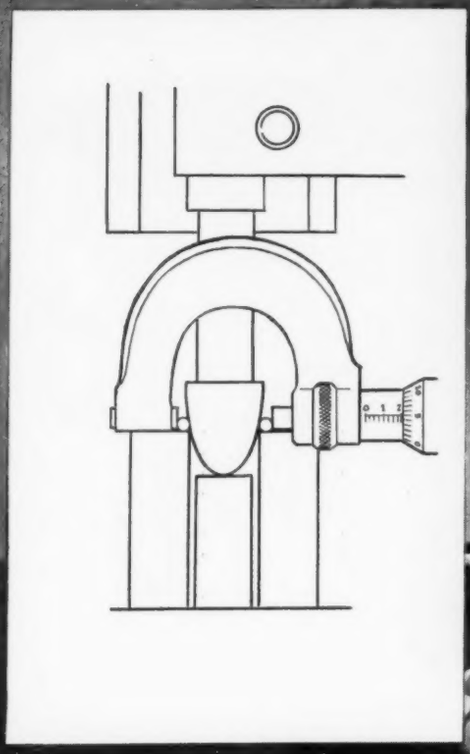
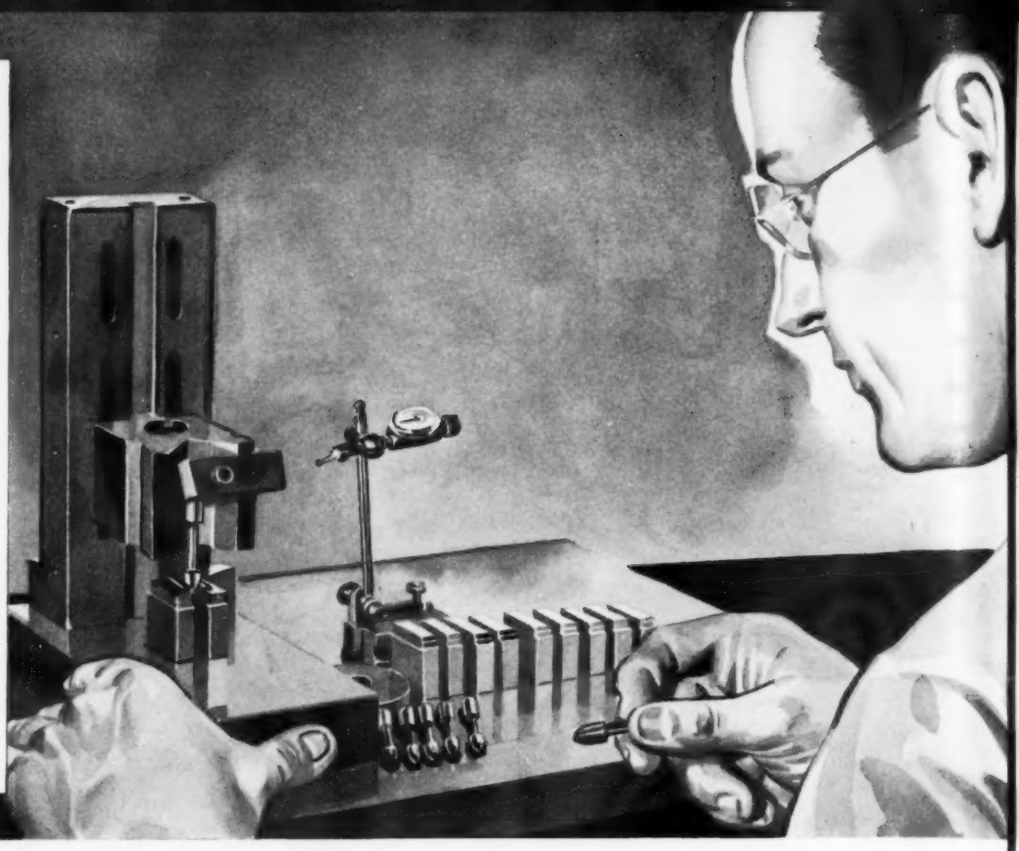
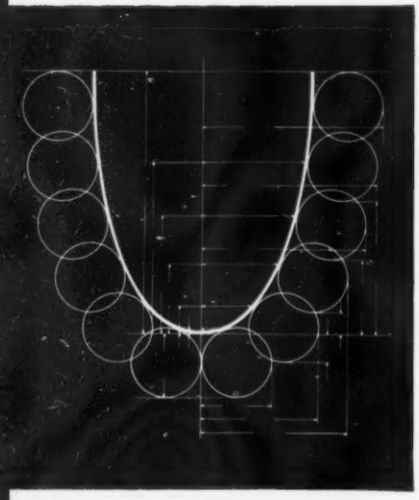




HOW TO MEASURE PRECISION BULLET GAGE CONTOURS



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Draft in Inches for Die Clearance Angles—II

BY W. J. WOODWORTH AND P. T. WOODWORTH

Depth	4°	4°30′	5°	5°30′	6°	6°30′	7°	7°30′
1/64	.00109	.00123	.00136	.00150	.00164	.00178	.00192	.00206
1/32	.00218	.00246	.00273	.00301	.00328	.00356	.00384	.00412
3/64	.00327	.00369	.00399	.00451	.00492	.00534	.00576	.00618
1/16	.00437	.00492	.00547	.00602	.00657	.00712	.00768	.00823
5/64	.00545	.00615	.00672	.00752	.00820	.00890	.00960	.01030
3/32	.00655	.00738	.00820	.00903	.00985	.01068	.01152	.01235
7/64	.00763	.00861	.00985	.01053	.01148	.01246	.01344	.01442
1/8	.00874	.00984	.01094	.01204	.01314	.01424	.01535	.01646
9/64	.00981	.01107	.01218	.01354	.01476	.01602	.01728	.01854
5/32	.01092	.01230	.01367	.01505	.01642	.01780	.01920	.02058
11/64	.01199	.01353	.01491	.01655	.01804	.01958	.02112	.02266
3/16	.01311	.01476	.01641	.01806	.01971	.02136	.02303	.02469
13/64	.01417	.01599	.01764	.01956	.02130	.02314	.02496	.02678
7/32	.01529	.01722	.01984	.02107	.02299	.02492	.02688	.02881
15/64	.01635	.01845	.02037	.02257	.02460	.02670	.02880	.03090
1/4	.01748	.01968	.02187	.02407	.02628	.02848	.03069	.03291
17/64	.01853	.02091	.02310	.02558	.02788	.03026	.03264	.03502
9/32	.01966	.02214	.02461	.02709	.02956	.03204	.03456	.03704
19/64	.02071	.02337	.02583	.02859	.03116	.03382	.03648	.03914
5/16	.02185	.02460	.02735	.03010	.03285	.03560	.03838	.04115
21/64	.02289	.02583	.02856	.03160	.03444	.03738	.04032	.04326
11/32	.02403	.02706	.03010	.03311	.03613	.03916	.04224	.04527
23/64	.02507	.02829	.03129	.03461	.03772	.04094	.04416	.04738
3/8	.02622	.02952	.03281	.03611	.03942	.04272	.04604	.04937
25/64	.02725	.03075	.03402	.03762	.04100	.04450	.04800	.05150
13/32	.02849	.03198	.03559	.03913	.04270	.04628	.04992	.05350
27/64	.02943	.03321	.03675	.04063	.04428	.04806	.05184	.05562
7/16	.03059	.03444	.03829	.04214	.04599	.04984	.05393	.05761
29/64	.03161	.03567	.03908	.04364	.04756	.05162	.05568	.05974
15/32	.03277	.03690	.04108	.04515	.04927	.05340	.05760	.06173
31/64	.03379	.03813	.04221	.04665	.05084	.05518	.05952	.06386
1/2	.03496	.03935	.04374	.04814	.05255	.05696	.06139	.06582
33/64	.03597	.04059	.04493	.04966	.05412	.05874	.06336	.06798
17/32	.03741	.04182	.04659	.05117	.05584	.06052	.06528	.06996
35/64	.03815	.04305	.04773	.05267	.05750	.06230	.06720	.07210
9/16	.03933	.04428	.04923	.05418	.05913	.06408	.06928	.07407
37/64	.04033	.04551	.05046	.05568	.06068	.06586	.07104	.07622
19/32	.04151	.04674	.05206	.05719	.06241	.06764	.07296	.07819
39/64	.04251	.04797	.05319	.05869	.06396	.06942	.07488	.08034
5/8	.04370	.04920	.05468	.06018	.06570	.07120	.07673	.08228
41/64	.04469	.05043	.05592	.06170	.06724	.07298	.07872	.08446
21/32	.04588	.05166	.05755	.06321	.06898	.07476	.08064	.08642
43/64	.04684	.05289	.05865	.06471	.07052	.07659	.08256	.08858
11/16	.04807	.05412	.06019	.06622	.07227	.07832	.08463	.09053
45/64	.04905	.05535	.06138	.06772	.07380	.08010	.08640	.09270
23/32	.05025	.05658	.06304	.06923	.07545	.08188	.08832	.09465
47/64	.05123	.05781	.06411	.07073	.07700	.08368	.09024	.09682
3/4	.05244	.05903	.06503	.07221	.07883	.08544	.09208	.09873
49/64	.05341	.06027	.06684	.07373	.08020	.08721	.09408	.10094
25/32	.05462	.06150	.06853	.07525	.08202	.08900	.09600	.10288
51/64	.05559	.06273	.06957	.07675	.08340	.09077	.09792	.10506
13/16	.05681	.06396	.07111	.07826	.08541	.09256	.09998	.10699
53/64	.05777	.06519	.07230	.07976	.08660	.09433	.10176	.10918
27/32	.05899	.06642	.07402	.08127	.08859	.09612	.10368	.11111
55/64	.05995	.06765	.07503	.08277	.08980	.09789	.10560	.11330
7/8	.06118	.06888	.07655	.08425	.09193	.09968	.10742	.11519
57/64	.06213	.07011	.07776	.08578	.09300	.10145	.10944	.11742
29/32	.06366	.07134	.07951	.08729	.09516	.10324	.11136	.11934
59/64	.06431	.07257	.08049	.08879	.09620	.10502	.11328	.12154
15/16	.06555	.07380	.08205	.09030	.09855	.10680	.11533	.12345
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31/32	.06773	.07626	.08400	.09331	.10173	.11036	.11904	.12757
63/64	.06867	.07747	.08595	.09481	.10260	.11213	.12096	.12978
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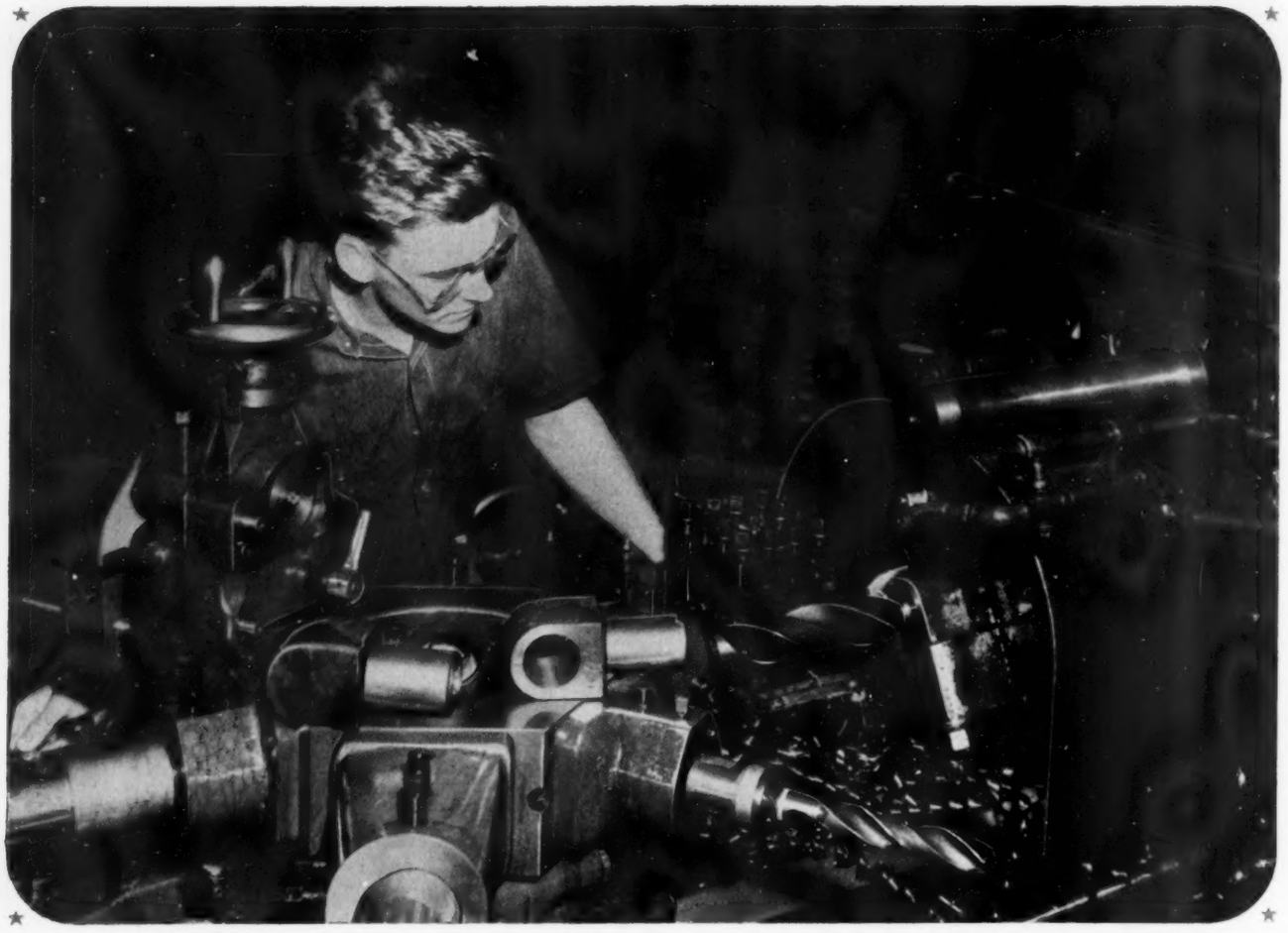

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How Much Is Enough?

IN FOOTBALL, the player carrying the ball darts first here and then there, taking advantage of every opening which suddenly appears. He and his fellow players must be ready to switch tactics quickly. Flexibility must be their watchword.

Defending players must be no less speedy in transferring their power from one spot on the field to another. Each team throws in its reserves and changes its strategy as its position dictates at the moment.

Tactics in war and in production of equipment for war closely resemble those in football. If you expect to win, you must be ready in a hurry to accommodate yourself to rapidly changing conditions.

You may need a certain type of tank today and thirty days hence it becomes urgent that a tank of different design be built. Today you must fight in the air at 12,000 feet. Several months from now the enemy's tactics make it imperative to develop planes which give maximum performance at 30,000 feet.

That's why we cannot get excited over the idea of statisticians and theorists that we are making too many machine tools, thus creating too much fabricating capacity in relation to raw materials available.

Our productive facilities necessarily must be flexible. We must be able to channel our steel from guns to tanks to planes to other war weapons as the need arises. It is inevitable in war that first the emphasis will be on producing tanks and then on turning out something else. Such developments must come with the changing fortunes of our forces in the field.

Never will it be possible or desirable to have an even balance between raw materials and fabricating capacity.

As George Johnson, retiring president of the National Machine Tool Builders' Association, emphasized last week, "the situation in which our total capacity to fabricate materials is actually greater than our total supply of available materials is not only healthy, but absolutely necessary."

Enough machine tools must be made that a peak demand can be met in a particular branch of the war production program whenever it occurs. Until we possess the machine facilities to do just that, we shall not have sufficient flexibility in our war production.

This war already has brought a rapid evolution in war weapons. Bigger and heavier guns, higher-powered aircraft, tanks with better armor and more firepower. New models aren't brought out yearly, as in Detroit's automobile days, but every few months. All this means a constant demand for machine tools and a necessary fabricating capacity far in excess of raw materials capacity.

We are going to need a lot of machine tools in the next year as we get deeper into the war. We don't want to build machine tools which won't be used or which are not essential.

But at the same time, we don't want to get caught short at a critical moment. It will be much better to play safe by building too many than by finding out later that we have too few.

Burnham Finney

GAGING BUSINESS

Hit-or-miss ordering will give way to scheduling, imposing more responsibility on industry. Number of products made in each plant will be reduced, expansions limited

Definite planning and scheduling of the war production program is about to emerge from what many industrial executives have described as a "messy situation." The period of hit-or-miss ordering, of indiscriminate granting of priority ratings, of guessing at requirements ahead, is about over.

Allocations of materials on strict time schedules will be made by the first quarter of 1943. Such allocations are necessary if we are to make more intelligent use of the materials we possess. Instead of giving everything a top rating as under the priority system, allocations will mean that wherever an item is moved up in scheduling, something else comes down.

More Responsibility—Scheduling will impose on all war goods manufacturers more responsibility. It means that the company which gets ahead of schedule is just as much to blame as the firm which falls behind. It got some materials which should have gone elsewhere for immediate use. No overall master plan has appeared or is likely to be devised soon for the war production program, but a real effort is being made to get at the facts on which to base industrial requirements for the war.

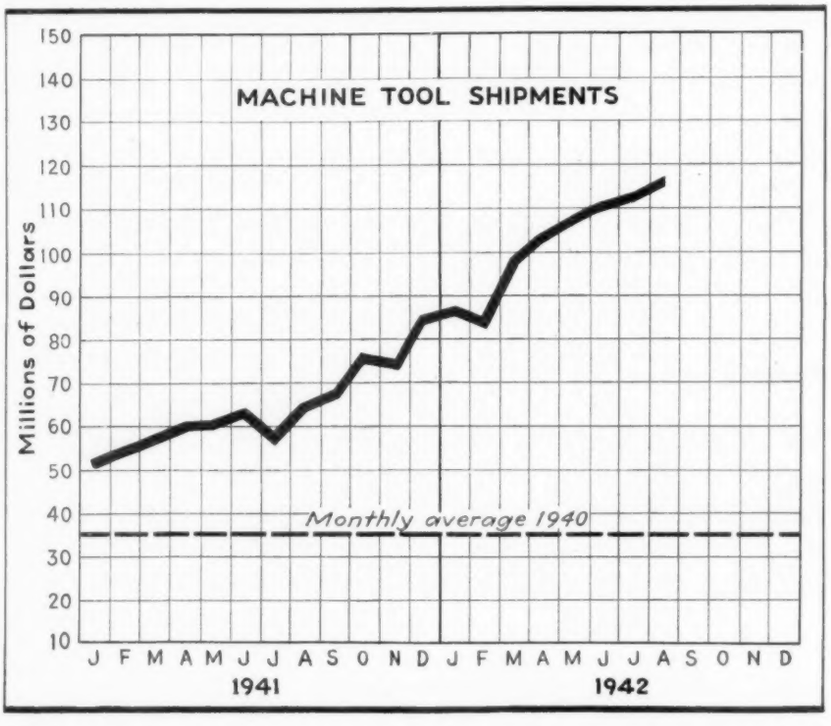
Machine Tool Survey—Probably the best example is in the machine tool industry where a top-flight committee of nine manufacturers is meeting four days a week in Washington, at the invitation of the Director of Tools Division of the War Production Board, to examine the war needs for machine tools. It is having sessions with many government groups—Army, Navy, Air Corps, Lend-Lease. When the survey is completed, the industry and Washington will have a much better idea of the minimum load on the industry the next six months. This same sort of planning is being done in some other groups. The point is that the lack of any intelligent planning, the amount of overlapping by agencies, the shot-in-the-dark manner of doing things, are being displaced by something better. How much better remains to be seen, but the situation appears promising.

Production Rate Up—In August the machine tool industry produced 29,100 machine tools valued at $117,442,000, compared with $113,600,000 in July. Output thus has risen to a rate of $1,400,000,000 a year, or about 14 times the volume in an average peacetime year. Last year production amounted to $771,400,000, the present going rate representing an increase of 83 percent. The September total is estimated to have exceeded the August figure. Machine tool plant expansions begun since Pearl Harbor, now 80 percent completed, will add some $300,000,000 to the industry's capacity. Much of this new capacity will be in production during the current quarter and will help to boost machine tool volume to higher peaks.

Basic Changes in Policies—Basic policies for securing increased war production are being changed rapidly. Further expansion of facilities will be stopped, except where unavoidable. To get more output, existing plants are to have their operating rates brought up to rated capacity. Many new facilities are working far below the rates of which they are capable for reasons that heretofore have been accepted as unavoidable. The official attitude will be changed to conform to the idea that plants must be used to the limit. In many cases pressure will be applied to get more production without even allowing additional outlay for more equipment.

To Overcome Shortages—Shortages of raw materials will be partly overcome by radically new designs of war products. In the production of one important item, for example, of which hundreds of thousands of units are required, losses of raw materials ran around 55 percent in machining. The supply of alloy steel used was limited. A shift to a different method of fabrication reduced the amount of scrap to less than five percent.

Production Changes Pending—Sweeping changes in raw materials production also are in the making. It is planned to reduce the number of products made in each plant. For example, a steel mill rolling 30 specifications will be obliged to concentrate on those it can produce most effectively, which may be only half a dozen. The same idea will carry through to a wide variety of materials and semi-finished products. Increases in productive capacity up to 20 percent are expected from the application of this policy. In finished goods, the gains are counted on to be even larger. Through this policy it is expected that many planned new factories and much expansion of existing plants may be avoided. The carrying out of this policy is likely to be left to a board which is made up of men who come from the industry affected.



Production Up—August output of machine tools was 29,100 units valued at $117,442,000. During July 28,300 units valued at $113,600,000 were shipped. Value in August was an increase of 83 percent over August, 1941

Byrnes Heads Wage and Price Stabilization

Order permits manipulating price ceilings to eliminate oxorbitant profits. Wage determination is removed from the area of collective bargaining, $25,000 limit near

BY ROBERT COLBORN

WASHINGTON—Most startling clause in the President's executive order setting up the new office of Economic Stabilization is the one directing the Price Administrator to manipulate price ceilings so as to eliminate "unreasonable or exorbitant" profits. This would mean almost anything. It could be a mere adjunct to renegotiation of war contracts. It could indicate a re-examination of every price ceiling in the light of company profit positions; regulation by special ceilings adjusting unduly profitable prices downward corresponding to recent moves to allow prices to slide up where a squeeze has occurred.

Primary importance of the profit clause however is for the future. Wartime regulations—regulations of prices, of materials, of manpower, of production—are pushing the country farther and farther from the distant days of supply and demand. Up to now, the usual price fixing procedure has been to freeze some past price which is assumed to have been set by the operations of the market.

When the Past Is No Guide

Increasingly situations will arise in which past experience offers no reasonable guide to present practice, in which a price will have to be built from the ground up. For such an operation, Henderson needs the power to deal with profits.

For example, concentration of sugar refining into about nine plants is now being studied. The economies which will result are so great that huge profits would be realized at present or recent prices. Clearly, price determination in such a case has to be based on cost figures plus a reasonable profit—with Henderson deciding what's reasonable.

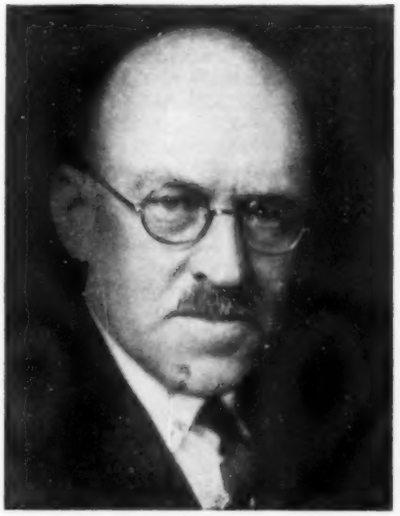
Future of Wages Is Vague

Future of wages under the regime of economic stabilizer James Byrnes is an enigma. It is clear that wage determination except in the smallest plants has been removed from the area of collective bargaining. It is clear that Byrnes is authorized, if he so wishes, to freeze all wages as of September 15. It is equally clear that Byrnes can permit wages to go up to any extent he wishes—by the 15 percent cost of living increase between January 1, 1941 and May 9, 1942, to reflect subsequent increases, or in accordance with any other formula or policy. The language is very broad, permitting increases "necessary to correct maladjustments or inequalities, to eliminate substandards of living, to correct gross inequities, or to aid in the effective prosecution of the war."

Specific Salary Limits

No controls are established on salaries under $5,000 but men now earning more than that can't get increases unless they are assigned to more responsible or difficult work or unless Byrnes himself approves.

The $25,000 limit on net salary after payment of taxes chargeable to the salary is no pipe dream. Only exception is provision for premiums on existing insurance and payments on existing obligations and prevention of "undue hardship." The procedure by which salaries above this limit will be denied recognition as a cost in computing taxes or war contracts has not yet been worked out, but the President has directed Byrnes to do so. Byrnes has asked the Treasury to recommend regulations for enforcing the $25,000 net salary limit.



Management Advisor — Ralph Flanders, president, Jones & Lamson Machine Co., has been chosen by President Roosevelt as an industrial advisor to James F. Byrnes of the Economic Stabilization Board on management. The other industrial advisor is Eric Johnston, president, U. S. Chamber of Commerce. Labor members of the board are William Green and Philip Murray

NEW ALLOY STEEL CHIEF

WASHINGTON—William J. Priestly, vice president of the Electro Metallurgical Co. of New York, has been chosen as chief of the alloy steels unit of the Iron & Steel Branch according to an announcement just made by Hiland G. Batcheller, chief of the Branch. Mr. Priestly was formerly connected with Bethlehem Steel Co. and later supervised the building and operation of the U. S. Naval Ordnance plant at Charleston, W. Va. Mr. Batcheller has named A. Oram Fulton, president of Wheelock, Lovejoy & Co. of Boston, who has been chief of the alloys unit, to assist him with steel distribution problems.

Committee Reviews Machine Tool Requirements of War

WASHINGTON—A subcommittee of the Machine Tool Industry Advisory Committee is now in the process of reviewing the machine tool situation and arriving at conclusions regarding the war requirements, both present and future, for machine tools, according to George C. Brainard, director of the Tools Division of the War Production Board. This committee was called together and assigned this task by Mr. Brainard.

Meetings are being held with representatives of the armed services, Maritime Commission, Lend-Lease and other large purchasers of machine tools to examine their needs and discuss future programs. In addition, conferences are taking place with top-flight civilian and military personnel as well as with those whose viewpoints statistically have a direct bearing on the problem. The sessions already have extended over three weeks. The study is expected to take a minimum of six weeks.

Members of the committee are doing this job as a staff function of the Tools Division of WPB and are serving on a "without compensation" basis. All the facilities of the Tools Division are at their disposal. The committee consists of Ralph E. Flanders, Jones & Lamson Machine Co., A. G. Bryant, Cleereman Machine Tool Co.; Ralph W. Burk, Kearney & Trecker Corp.; John S. Chafee, Brown & Sharpe Mfg. Co.; Arthur H. Ingle, Consolidated Machine Tool Corp.; R. F. Ingram, Landis Tool Co.; Walter W. Tangeman, Cincinnati Milling Machine Co.; R. J. Whiting, Hydraulic Press Mfg. Co.; and George H. Johnson, Gisholt Machine Co., ex officio.

Freezing of Labor May be Extended Soon
American Management Association Is Told

NEW YORK—Manpower stabilization similar to that recently ordered in the lumber and mining industries may come shortly for the tool and die industry in Detroit and the airplane industry on the West Coast, Fowler V. Harper, deputy chairman, War Manpower Commission, told a conference on Manpower and War Labor Problems held at the Hotel Pennsylvania here on September 29 and 30. The meeting was sponsored by the American Management Association.

If involuntary and cooperative methods of dealing with manpower shortages prove inadequate, Mr. Harper said, the War Manpower Commission will be ready with legislation to remedy the deficiencies. Shortages exist today in thirty-five industrial areas, he pointed out, a shortage is expected in eighty-one areas, and in only thirty-four areas is the supply of manpower sufficient.

Every single individual must be utilized to the fullest extent, in a selective way. Mr. Harper said that too often a man who should be building a tank is a private waiting for the tank to be delivered.

Training Must be Speeded

"We have had to throw away a lot of yardsticks" said Major General Lewis B. Hershey, Director, Selective Service System. He told industry that it must forget how long it takes to bring a man to a certain skill. Production in Britain stepped up after the declaration of war, he said, went up again after Dunkirk, but they realized they had seen nothing after the blitz began. "Our job would be much easier if factories were bombed two or three times a week," General Hershey said.

Management must look itself over objectively and decide what absolute minimum will be necessary to keep business running. Every effort should be made to see that "removes" are orderly, as men are drawn into the armed forces. If a firm will make its absolute minimum known on Form 42A, it will find most selective service boards anxious to be cooperative. But don't expect anyone to tell you that here is a man you can always have, General Hershey said.

The average rate of turnover on an annual basis in the civil service is now 42.5 percent, Arthur Flemming, Commissioner, U. S. Civil Service Commission told the meeting. In departmental personnel the annual rate of turnover is 82.5 percent.

Pirating must be stopped, Mr. Flemming said, but if the government can hire a man at his highest skill they will do it. Likewise, if industry can hire a government employee at his highest skill they should do the same.

Dynamic Labor Solution

William H. Davis, Chairman, National War Labor Board said that we have found in this war a dynamic solution for the labor problem which is much better than the partial solution found in the last war. "There is no threat of strikes to industry today," Mr. Davis said. Loss from strikes is insignificant compared to losses from illness or from absenteeism.

Next year at least 10 percent of the working force in the shipbuilding industry will have to be women, Paul R. Porter, chairman, shipbuilding stabilization committee WPB, told the meeting. At least 150,000 women will have to be employed.

Associated Machine Tool Dealers Elect
Harrington President at Annual Meeting

NEW YORK—Dan Harrington, president of Wilson-Brown & Co., New York, was elected president of the Associated Machine Tool Dealers of America at the annual meeting at the Hotel Pennsylvania, October 7. Albert M. Stedfast, Stedfast & Roulston, Inc., Boston, now assistant chief of the Tools Division of WPB, will continue as first vice president.

A. B. Einig, general manager of the Motch & Merryweather Machinery Co., Cleveland, was named second vice president. George Habicht, Jr., general manager of the Marshall & Huschart Machinery Co., Chicago, will serve as secretary and treasurer. New directors elected were T. W. Harron, president of the Harron, Rickard & McCone Co., San Francisco; Leo H. Gorton, Machine Tool & Supply Co., Tulsa, Okla.; and C. S. Bradeen, Canadian Fairbanks-Morse Co., Ltd., Montreal.

Brigadier General H. F. Safford, chief of the Production Service Branch, Industrial Service, Office of the Chief of Ordnance, War Department, talked at the general session on the conservation of production machinery and materials. N. P. Lloyd & Arms, Inc., Philadelphia, discussed the activities of the machine tool panels in the U. S. army ordnance districts. Mason Britton, vice president of the McGraw-Hill Publishing Co., made informal remarks on the progress of the war production program.

The association conducted an executive session in the morning at which reports of various committees were heard. A. G. Bryant, chairman of the Committee on Government relations, made a report on the Washington situation. Mr. Bradeen talked on sales procedure in Canada.

Fred B. Scott, Syracuse Supply Co., Syracuse, N. Y., retiring president of the association, presided at the two sessions and at the luncheon.

Officers of Associated Machine Tool Dealers

DAN HARRINGTON

ALBERT M. STEDFAST

A. B. EINIG

New Production Drive Head

WASHINGTON—William G. Marshall is due to be named to head a joint committee of labor and management which will take over the management of WPB's Production Drive. The appointment stems from Marshall's personal acceptability to both labor and industry and from the excellent record established by the Production Drive committee at Westinghouse, where Marshall is vice president in charge of industrial relations.

Machine Tool Builders Determine to Hit Higher Goal

Balance of machines needed for war program must be built speedily as possible. Plant expansion about 80 percent completed, resulting in big gain in output this quarter

NEW YORK—Determination to drive on to still higher production goals for the war effort was the dominant feeling at the forty-first annual meeting of the National Machine Tool Builders' Association at the Waldorf-Astoria Oct. 5-6. The program departed from precedent, as general sessions were held the afternoon of the first day and the morning of the second, with group meetings the morning and evening of the first day.

In line with the desire to supply still more badly-needed machine tools as quickly as possible, president-elect John S. Chafee, vice president of the Brown & Sharpe Mfg. Co., announced at the close of the meeting that he was offering a president's cup to the machine tool builder who had the largest percentage of increase in units produced during the fourth quarter compared with the third quarter.

It is vital that the building of the balance of the machine tools required for the war program be speeded, according to George H. Johnson, president of the Gisholt Machine Co., in his presidential address. He stressed that the job is not yet done, although "we can see a time ahead of us when our initial task of retooling American industry for war production will have been completed."

Distribution of Backlog

The industry's backlog of over a billion dollars, representing eight months' output on the average, is not well distributed and some plants will have excess capacity before others. In such cases they will be used to make parts for planes, guns, tanks or other munitions, or to manufacture parts for other machine tool builders.

Mr. Johnson said that "the government and the machine tool industry are closer to a mutual understanding and solution of the nation's machine tool war production problems than has ever before been the case. Provided the present situation is not upset by unforeseen developments, I believe the machine tool industry is to be given intelligent and careful consideration by the people in Washington who today are coordinating the war effort."

Machine tool companies might as well recognize that a sizable portion of their present forces will be taken by the draft and that the only solution is employment and training of women, declared Mr. Johnson.

"It is not sufficient that we build enough machine tools to machine all of the raw materials available," warned Mr. Johnson. "We must make enough machine tools so that when a peak demand occurs in a particular branch of the war production program, that peak demand may be met." There must be in existence the flexibility of production required by the changing fortunes of war.

Need is Still Critical

Never has there been a time when certain critical requirements for incomplete or contemplated programs for America's armed forces, the other members of the United Nations and other strategic uses have been more acute than right now, said George C. Brainard, Director of Tools Division, War Production Board, in an address. He said that despite the fine job done by the industry, it is at least $10 million a month behind the forecasts made earlier in the year. He urged that this deficit in output be made up in the final quarter.

He reported production of machine tools totaling $137 million during August, or an annual rate of $1,650,000,000. A large part of the output was underwritten by pool orders. Plant expansions in the industry since last December amounted to $77 million, with an expected increase in production of $300 million. The expansion program is about 80 percent completed. A considerable gain in production from these new facilities should be realized in the current quarter.

Mr. Brainard is of the opinion that the peak of machine tool output and of the tooling up of new manufacturing capacity will not be finished for months. He is opposed to converting any of the industry's capacity to the building of implements of war until "we are dead sure that it is safe to do so" and that it will not be needed again during the war for making machine tools.

Where one machine tool company can make short deliveries and another company long deliveries, an effort must be made to transfer orders from the latter to the former to procure all the machine tools for war purposes in the shortest time, suggested Mr. Brainard. If the time to complete a plant expansion is too great, machine tool builders with heavy orders should try to subcontract work to other companies having open capacity.

Mr. Brainard informed the industry that the Production Requirements Plan now in effect will continue through the fourth quarter and, with some modifications, through the first quarter of 1943. A more complete modification will be possible in the second quarter of next year. Machine tool builders have been assigned a flat rating of AA-2-X for all materials to be purchased for production. It appears that materials which builders are authorized to buy this quarter will be all that is available and that filing of applications for additional quantities will do no good.

Women now employed in machine tool plants are proving to be surprisingly satisfactory substitutes for men, said Mr. Brainard. He stressed that the industry must get the required production regardless of the unavailability of the usual labor supply.

England's Experience

The average delivery offered by British machine tool plants is ten months, and some machines cannot be obtained before 15 to 16 months

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GEORGE C. BRAINARD

stated Freas M. Long, export sales manager of the Gisholt Machine Co., in an address on "Machine Tools in England." Mr. Long recently returned from a study of England's machine tool and war industries made for the Tools Division of WPB.

The backlog of machine tool orders in England is greater than a year ago because fewer U. S. machines are being imported. The industry there is steadily stepping up production. In 1935, for example, only 1,800 ram type turret lathes over 1-in. capacity were produced. Estimated output next year will be 6,078. Factors preventing larger increases were the necessity for making direct fighting tools and importing machine tools from here, and the dearth of new machine tool plants and of additions to old ones because of the need of other war industries for skilled men and materials.

Women in England

British machine tool companies have lost many experienced workers to the services and to the war industries and have been harassed by aircraft bombings, which caused damage mostly by fire. The number of women in machine tool and small tool plants more than doubled in 1941, reaching 25,223 last June. It is still on the increase, said Mr. Long.

Mr. Long believes that machine tools in British war plants are being efficiently used and cared for. All vital machines, such as jig borers, gear cutters and others difficult to replace, are dispersed in the plants and protected from bomb blasts by reinforced blast walls or cells. Large automatics and special machines are being operated at maximum capacity on work best suited to them. Old machines are being used shrewdly. In one old shop 42-year-old boring mills are machining light cast iron brackets for searchlights and for similar jobs.

Further to improve utilization of machines, the British Machine Tool Control has organized groups of specialists from machine tool plants to assist users in training operators and providing proper tooling for their machines. There are 225 men in two groups loaned to the Ministry by 75 different firms.

The British still need machine tools, though not as many as in the past. Mr. Long said that some standard types and special machines must be sent over from here. In some cases England has waited for months for certain American machine tools desperately needed to complete an essential production line. In certain instances machines of doubtful value have been shipped. In the future the British will furnish Washington with definite information on machines required.

Machine tool builders should not wait until too late to ask for deferment of key skilled workers, said Captain E. R. Henning, U.S.N., Machine Tool Section, Army and Navy Munitions Board, speaking on "Man Power." He urged all companies to maintain records of the draft status of all employees and to submit form 42a for further deferment at least a month before present deferments expire. He emphasized that the WPB has attempted to protect to the utmost vital workers in the machine tool industry.

A special occupational bulletin for the machine tool industry is expected to be issued by the Manpower Commission to local draft boards, revealed Captain Henning. He warned, however, that the industry cannot expect an umbrella to be held over it and that the effort to employ women must be increased.

Ralph Flanders, president of the Jones & Lamson Machine Co. and chairman of the government relations committee of the association, discussed at some length the renegotiation of contracts. Among other things, he pointed out that the machine tool industry's ratio of liquid assets to liabilities has been going down continuously since 1929 and that the solvency of the industry depends largely upon pool orders. He referred to machine tools as an industry of "fever and famine." William Kelly, president of the Machinery and Allied Products Institute, spoke briefly on contract renegotiation.

Material Problems Cited

In his report as general manager of the association, Tell Berna said that priorities function satisfactorily in securing materials only when an ample supply of materials is available. The answer to the present problem is allocation. He made the point that WPB is expecting machine tool builders to keep production at capacity, though steel is not received for that amount. He expressed the belief that more steel will be available during the first quarter. He told of the difficulty in getting an accurate record of machine tools on order. Some 23 government agencies are interested in these records. The card file system established by Howard Dunbar, vice president of the Norton Co., during his long tenure in the Tools Division of WPB was pronounced the best by Mr. Berna.

Wendell E. Whipp, president of the Monarch Machine Tool Co., read a paper telling about women employees at his plant. This paper will be published in full in the next issue of AMERICAN MACHINIST.

In addition to Mr. Chafee as president, the association elected Walter W. Tangeman, vice president of the Cincinnati Milling Machine Co., as first vice president; Fred H. Chapin, president of the National Acme Co., as second vice president; and David Ayr, president of the Hendey Machine Co., as treasurer. Joseph Trecker, vice president of the Kearney & Trecker Corp., was elected to the board of directors. Other new board members are Mr. Tangeman and Mr. Chapin. Mr Berna continues as general manager of the association and Mrs. Frida F. Selbert as secretary.

INSIDE DETROIT

Auto industry reaches "self-supporting" status in scrap salvage. Industry expert outlines functions of successful plant organization. Wage-price interpretations expected

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Officials of the Conservation Division, WPB, stated positively before the salvage conference of the Automotive Council for War Production that failure by American industry to provide the major share of the 17 million tons of steel scrap required in the last six months of 1942 will undoubtedly set the stage for confiscation of metal now held in the form of finished parts as well as in partially fabricated stages.

That threat does not apply to the automobile industry alone. The Industrial Salvage Section has circularized 70,000 industrial concerns, telling them that a special drive is underway for the 90-day period from October through December. In addition to speeding the return of production scrap to the mills, these companies are asked, with respect to dormant scrap, to: (1) instruct plant salvage executives to determine all scrappable items, (2) to mark such items, and (3) dispose of at least one-third of total tonnage of dormant scrap in each of the three months. To insure compliance, and to assist industrial salvage authorities, plant visits will be made every 30 days by the Section's 140 field men, aided by 2,500 salesmen and sales executives drawn from the ranks of the major steel companies, the American Steel Warehouse Assn., and the Associated Equipment Distributors.

What Is Dormant Scrap?

The question arises, "What is dormant scrap?" Certainly the automobile industry is not going to follow blindly the slogan adopted by the Industrial Salvage Section—"If it hasn't been used for three months, and no one can prove that it can be used in the next three—find a use for it or scrap it." Nor has the industry agreed unreservedly with the definition issued by the Section:

"Dormant scrap is defined as obsolete machinery, tools, equipment, dies, jigs, fixtures, which are incapable of current or future use in the *war production effort* because they are broken, worn-out, irreparable, dismantled or in need of unavailable parts necessary to practical re-employment."

In checking with the Automotive Council for War Production upon the results of the industry's scrap drive since June (337,000 tons were collected in the three months ending with August), Paul C. Cabot, Deputy Chief, Conservation Division, WPB, and Hamilton Wright, Chief, Industrial Salvage Section, expressed themselves as satisfied with the efforts of the industry to date, and pleased with the latest recommendation by the Council. The new ACWP policy urges the scrapping of all tools, dies, and fixtures for the manufacture of replacement parts where demand indicates that such equipment is no longer necessary for the maintenance of essential automotive transportation.

Would Scrap Idle Machines

Immediately after the salvage conference in Detroit, newspapers drew from Donald Nelson the opinion that 1942-model tooling and idle machinery should be scrapped. This suggestion was immediately criticized by automotive spokesmen, who stressed the economic considerations involved in starting up postwar production from scratch. Furthermore, after rehearsing the fact that automobile manufacturers were the first industrial group to organize a salvage campaign which parallels the current "dormant scrap drive," the Automotive Council reported that 85 percent of the industry's equipment is already working on war materials, with the balance available to any other producer. A large part of the remaining inventory of special purpose machinery is stated to be a vital source of parts to repair war-production equipment. Detroit sources regard it as unfortunate that Nelson did not ask his salvage experts to answer the questions put by the Washington press.

The rooting of dormant scrap from 70,000 industrial plants is not a glamorous business, but it does call for organized effort. One of the first things the Automotive Council recommended to its members was: appoint a plant salvage authority with adequate responsibility. That policy has worked, for in currently turning back enough raw material to produce over 5 million tons of new steel annually, the automotive industry can claim to be "self-supporting" in the war effort, even in the period while still tooling up.

In reporting on the methods used by auto firms to achieve this record,

DEPUTY DIRECTORS APPOINTED

DETROIT—D. J. Hutchins, director of this region for the War Production Board, has appointed tw ostaff members as deputy regional directors. They are: Hugo A. Weissbrodt, formerly manager of field operations, who becomes deputy director for small war plants and production service; and James E. Wilson, formerly manager of priorities division, who becomes deputy director of that division, with authority over many activities, especially compliance with priority orders, the production requirements plan and general appeals on limitations orders.

Actually Weissbrodt, in carrying out the decentralized activities of WPB's Smaller War Plant Division, will continue to obtain the widest possible use of small plant capacity.

Soldier Trainees—Soldiers dismantle aircraft turret. Several hundred men are being trained in Briggs Manufacturing Company's Turret Maintenance School, to maintainn this important Flying Fortress armament

P. O. Peterson of Studebaker stated at the salvage conference:

1. The salvage authority must have the power to render final decisions, even to deprive others of "hoardings". He should be able to write off possessions as losses, to classify and apportion these losses, to provide substitutes, and to bring about plant changes when they will contribute to scrap.

Technical Assistance Required

The nature of the salvage authority's decisions requires technical assistance from plant engineers, process engineers, replacement parts men, production departments, millwrights and maintenance men, purchasers, and outsiders like scrap, steel and machinery people.

2. Even in a small plant, the salvage job under present circumstances is more than a one-man job. An organization must be created to carry on the clerical and leg work. A staff must be organized by the salvage director to survey possibilities, list items, then study, classify, sort, break up, and carry material to the scrap pile. Adequate records are an absolute necessity, not only to speed the scrap salvage campaign but to establish the data upon which tax-deduction claims can be advanced. By keeping adequate lists of all types of equipment (particularly tools, dies and fixtures), one firm has already released 70 percent of items on the lists reviewed.

3. The industrial plant should incorporate in its system a method of accounting for equipment held by vendors and scrapped in the program. In some cases, auto firms have instituted a complete follow-up system which reports the exact disposition of the scrap to the salvage authority.

4. To sort and classify items in storage after the record-keeping stage, some method of labeling must be adopted. Some companies are giving red tags to foremen and workers to be put on doubtful items.

5. Centralized scrap pile areas should be established to which identified scrap should be transported as quickly as possible, and moved out of the plant.

6. A cost record of salvage operations should be maintained.

7. Sorting, classifying and dismantling operations are important to move scrap, and get the best prices. Some scrap dealers can help with the dismantling job.

Pay Order Raises Questions

The President's executive orders on overtime pay and economic stabilization have raised many questions which are still in process of being answered by the Department of Labor and the War Labor Board.

Still left up in the air with regard to overtime pay is the matter of whether overtime shall be paid for the sixth and seventh day when an employee has not put in a full 40 hrs. during the preceding five days. The interpretation of the Secretary of Labor says that the person who may work only say two or three hours a day for five days, is entitled to over time for the sixth and seventh days. However, the inability of the employee to work full days may arise from circumstances beyond the control of the employer, such as materials shortages. So the question remains: "Should the manufacturer be burdened with overtime payments where he is not at fault?"

The economic stabilization order has raised so many questions in regard to wage stabilization, that Chairman Davis of the War Labor Board has asked industry "to lay off" until the Board can analyze the problems already presented, and issue a set of interpretations. Probably the Board's answer will take the form of questions and answers.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

AIR CONDITIONING—Production of additional types of air conditioning and commercial refrigeration equipment has been prohibited. (General Limitation Order L-38 as amended Sept. 26.)

AUTOMOTIVE REPAIR—Machine shops supplying automotive repair, maintenance and rebuilding services are subject to price controls of the Service Trades. Price Regulation and should file with the local War Price and Rationing Boards statements of March prices. (Service Trades Price Regulation No. 165.)

CHROMIUM—Restrictions on the use of chromium chemicals were removed by the Director General for Operations. Inventory is limited to a 30-day supply and regular reports are required on Form PD-54. (Order M-18-b, as amended Sept. 30.)

FLUORESCENT LIGHTING—Limitation Order L-78, covering fixtures, which was due to expire October 1, has been extended to October 20. (Section 1153.1, General Limitation Order L-78.)

FROZEN STOCKS—Material rationed at retail levels is excluded, intra-company transfers of material in specified circumstances is included and certain ambiguities cleared. (Amendment 1, Priorities Regulation No. 13.)

COPPER SCRAP—Along with copper-base alloy scrap and ingot will be available to foundries only when their orders bear preference rating of A-1-a or higher. (Letter from Director General for Operations, WPB, Sept. 23.)

IRON AND STEEL—Producers will be permitted to accept deliveries of maintenance, repair and operating supplies in excess of the amounts authorized under the Production Requirement Plans when necessary for essential operations. (Telegram from Director General for Operations, WPB, Sept. 21.)

IRON AND STEEL—Producers of iron and steel, ferro-alloys and blast-furnace coke will be permitted to use higher ratings during the fourth quarter for repair and maintenance supplies. (Preference Rating Order P-68 as amended Oct. 3.)

IRON AND STEEL PIPE—Dollars-and-cents maximum prices for reusable iron and steel pipe, cut ceiling quotations back to levels of October 1-15, 1941. (Maximum Price Regulation No. 230.)

METAL DOORS — Production of metal doors, frames and shutters for military or civilian use was prohibited by the WPB. (Limitation Order L-142.)

SAWS AND AXES—Simplification schedule covering saws, axes, hatchets, adzes and light hammers were issued. (Schedules II and III, hand tool simplification order L-157.)

Kanzler Plan is Approved; Will Push Pure Scheduling

WASHINGTON—WPB's erstwhile darling, the Production Requirements Plan, is coming to maturity just as its obituaries are being composed. The "Kanzler Plan" under which the new Director of Operations intends to take direct war production out from PRP and put on a pure scheduling basis (*AM*—Vol. 86, page 1126c) has received the official nod of Ferdinand Eberstadt, vice-chairman in charge of material distribution, and of Donald Nelson himself.

This means that about the second quarter of next year the producers of munitions—guns, tanks, ships, etc.—will be getting their materials on a new basis. Civilian and "shelf goods" production, accounting for a quarter to a third of the firms now on PRP, will continue under PRP.

Details of the new scheme are not yet complete. It will bear some resemblance to the so-called General Motors plan. Essence of it is that the armed forces prepare schedules, month by month, of production they expect of finished armament. The big prime contractors, who produce this finished stuff, will prepare corresponding schedules of production by their subcontractors and suppliers, including manufacturers who produce parts under prime contracts. They will also prepare bills of the materials needed to meet the schedules. These schedules would be submitted regularly to WPB, which would cut them down to match the materials available for military use. Then war contractors would receive authorization to buy any materials needed to meet approved schedules.

WARTIME WASHINGTON

Speed of shipbuilding today alters plans. Higgins working on a cargo plane. Further regimentation is ahead for business as tighter labor and material controls begin

BY BLAINE STUBBLEFIELD

WASHINGTON—There was nothing phoney about the Maritime Commission's steel-shortage excuse for closing the Higgins shipyard in New Orleans some weeks ago. The Commission, and all those associated with its ship program planning, far overestimated the need for ship plant in this war. But the Commission neither accepts nor places blame. Officials tell AMERICAN MACHINIST that reduction of Liberty shipbuilding time to one third the original estimate—from about 241 days to 70—is a phenomenon that never occurred to anybody, not even the most optimistic builder.

If the whole program of yards, including the Higgins yard, were now working, it would be down to about 60 percent of capacity for lack of steel. To be exact, the Commission expects to meet the President's directive: 24 million tons this year and next, with 16 million tons of that amount scheduled for 1943—with 57 percent of present capacity.

Liberty Ways Converted

Conversion of Liberty ways to other types of ships is the Commission's answer to the steel shortage. For example, the W. A. Bechtel yards at Sausalito, Calif., which has a contract for 34 Liberties, will turn to tankers following completion of the 12th Liberty. Evidently provision was made in the ways for this conversion. At first thought such a conversion would not seem to help the steel situation. But it will, because the speed work that chews up the steel is on Liberties, not on tankers. Actually, the conversion is to put the cargo-tanker ratio back in balance.

Combat ships are also being built on ways turned over by the Commission to the Navy. The kinds of combat craft are not disclosed, but presumably the new tank carriers are included. These boats do not take steel assigned to merchant shipping. The Navy is pleased, because it is getting equipment for which it has immediate need.

Higgins Plan for Planes

When the President was in New Orleans on his trip he visited the Higgins yard, and Higgins rode in the car with him. Mr. Roosevelt listened to Higgins' plans with interest, and now, as this is written, the Paul Bunyan of shipbuilding is in Washington, urging WPB and the Services to authorize the cargo airplane program which he proposed, even before Kaiser came into the picture.

Higgins reveals for the first time that he has had a staff of researchers at work for many months on the design of a cargo plane, size and type of which he does not make known, except to say that the major material would be plastic wood. He emphasizes that modern plastics are far better materials than they were a few years back.

The fishy eye is about all Higgins has got from responsible officials so far. He showed them his plans and a model of his plane, whereupon they reminded him that there is no available wood, copper, steel to meet his program. Higgins answers that there is more copper than he would need in years in illegal inventories that he can put his finger on, and he also promises to get all materials needed, except engines and instruments, entirely outside of existing WPB materials schedules.

Brushing Higgins off will not be any easier than it was to brush Kaiser off, for he operates in the same way, with press appeals direct to the public over the heads of the authorities. And furthermore, he's not even asking for an order. He is going ahead and build a pilot model on his own account, and then take chances on selling it to the government. Regardless of what the war leaders say, people like Higgins and Kaiser are convinced that a major portion of world shipping will have to be taken out of the water and put in the air before this war is won.

Procurement Control

When Nelson took Eberstadt into WPB as vice chairman in charge of the flow of materials, he "took" the Army-Navy Munitions Board, too, in the sporting sense of the word, according to the curbstone opinion. There is no doubt that the Services had played politics for control of their procurement. For after all, it was taken away from them. You will recall the Army's 10,000 industrial firms which held dummy contracts under the old Mobilization plan, and were going to start turning out planes, munitions, and tanks when the war chiefs pressed the button on "M" day.

Nelson Clarifies ANB

Nelson has insisted lately that there is no conflict between himself and the ANB. If that is true, it is partly because he beat the fighting starch out of it. He certainly had enough weapons, what with his powers under the law and under the executives.

A statement by Nelson the other day at a press conference seems to sum the matter up neatly. Asked how ANB would function from now on, he said: Some of its officers will move over here (to WPB) and work directly with us. Asked if there would be a new ANB chairman to replace Eberstadt, he said there would be. And he added that there would always be a place for ANB in the war program.

Regimentation Will Increase

Regimentation into a war economy has come pretty gradually to the businessman, although it may not have seemed that way at the time. His first priority certificate may have given him a premonitory shiver, but he was damned glad to get it. He may have been forced to switch from the refrigerator business to the machine gun business, but he is still in business. He takes a contract from the government and delivers the goods as fast as he can. That day is over.

Tight material controls with which Washington expects to meet the shortage problem (*AM*—Vol. 86, page 1126c) will leave mighty little room for the discretion of the individual businessman. He'll be told what to produce,

Roosevelt Reconnaissance — On his tour of Allis-Chalmers' Milwaukee plant, the President was accompanied by Walter Geist, company president, Max Babb, board chairman and Gen. B. H. Somervell

when, at what rate, in what order, how much material he can bring into his plant and when, at what rate he can withdraw materials from his own inventories.

Control in the Plant

And the orders he'll be taking won't come from a remote and anonymous Washington. They'll come from a man sitting at the next desk. Already used to getting along with an auditor and a production inspector from the War Department, the business man will have to get used to priority and scheduling inspectors checking his every operation. In big plants these will be men from the government; in small plants they're likely to be men from the big plants. These things are logical necessities, are definitely planned by responsible officials, are matters of the next six months or so.

Extent of Labor Control

Manpower controls in industry are something really new. Army and the war industries are cutting into the labor supply deeper than ever in the last war, and the impact is not yet fully realized. Businessmen are only now appreciating that they must expect to have many of their best men taken away to go to the army or to more important war jobs. They have yet to learn that labor controls will extend into every niche of their personnel policy.

Government men will prune the payrolls of every plant, working out the minimum labor force necessary and drafting or transferring the rest. This is already being done in some plants. Big employers will find labor utilization inspectors checking constantly on whether they are wasting or hoarding manpower. These inspectors are as likely to be men who come from the unions as men who come from management engineering. Employers will hire what men the Employment Service lets them, may be restricted in their right to fire.

Salvage Has Become Big Business; Many Firms Have Created Special Departments

NEW YORK—Industry has responded to the call for scrap with alacrity and thoroughness. During 1942, the General Electric Co. will recover and return 380 million pounds of waste material, ranging from outdated rubber stamps to an obsolete power plant. This is enough to fill 5,000 freight cars.

Intensive drives have been put on by most companies. Novel posters and stunts have served to keep the worker aware of the need of gathering scrap and of being careful not to spoil raw material. The Crocker-Wheeler Electric Mfg. Co., with the theme, "Dig in and Dig Out the Scrap," introduced a drive with a visit to the plant by those fictional detectives Sherlock Holmes and Doctor Watson, who proceeded to find many scrap items in corners, under benches and in the drawers. Many of the items were being hoarded, with the thought that they "might be of use some day." In addition to the regular salvage program which has been yielding an average of 550,000 lb. of critical scrap monthly, the company has set a quota of 200,000 lb. of the "might be of use some day" type of scrap.

Efficient Collection Systems

Westinghouse Electric & Mfg. Co. gathered an extra five million pounds of war-needed materials within the last three months, in addition to routine collections, as a result of an intensive scrap drive. One division accumulated 300,000 lb. of old metal parts; by rummaging through office desks, hundreds of pounds of metal paper weights and tons of paper were collected. In work benches almost five tons of high quality steel tools were found which were not being used enough to justify their presence there at this time of need.

Most companies have devised efficient systems of collecting, sorting and promptly dispatching scrap. Some large plants have thoroughly equipped salvage departments, their equipment including hydraulic baling presses, magnetic separators, chip crushers, torch cutting equipment, alligator shears and all types of handling equipment. Some have furnaces for refining lead, tin, babbitt and solder, distilleries and filters for reclaiming solvents and oils, laundry equipment to wash wiping cloths and canvas gloves and woodworking equipment for salvaging lumber.

Other good practices have been offshoots of the salvage program. Plant maintenance engineers have learned to use parts from outmoded and obsolete machinery to repair their equipment in operation. Unsightly clutters of obsolete and junked machinery have been cleared from the premises. Equipment which is no longer needed, but which might be of use to other producers, is being returned to machinery manufacturers for reconditioning and resale.

Grinder Sludge Saved

One machine gun plant found its grinder sludge contained 95 percent ferrous metal and obtained permission from the steel mill to ship the sludge with the other scrap. It developed a method of recovering steel, lead and copper alloy from the sand used to stop bullets on the proof firing range and recovered 20,000 pounds of material in the initial operation.

The National Association of Manufacturers has prepared an industrial film, "Let's Get in the Scrap," as a means of educating executive personnel on how to organize and successfully conduct an in-the-plant metal salvage campaign. Aware that most industrial plants have for years recognized the importance of production scrap and the income to be had from its sale, the film is aimed to bring out the metal left in hidden storerooms, partially fabricated parts, obsolete equipment and piles of odds and ends that have salvage value.

The American Industries Salvage Committee made a direct mail appeal to 17,000 top executives of all classes of industry and business, urging their wholehearted cooperation in the drive for scrap. They were urged to use their advertising and distribution facilities to drive home to everyone the vital message to get in the scrap.

Simplification Saving—By the old method a 56-lb. solid steel forging was machined to a 6-lb. finished part. By welding 14-lb. piece of steel tubing to a forged base, Pontiac engineers have reduced resultant scrap by 48 lb.

New York Ordnance Head

WASHINGTON—Col. Robert W. Johnson, formerly head of the District Administration Branch, Industrial Services Division, Office of the Chief of Ordnance, has succeeded Brig. Gen. Walter P. Boatwright as Chief of the New York Ordnance District Office. Gen. Boatwright is relieved on account of poor health.

LINES ON AIRCRAFT

Eastern pool of aircraft production data is formed. The output of aircraft industry in 1942 will fall a little short of the goal set by the President last January

A second pool of aircraft production technical data, critical materials and parts, and special skills, has been formed under the name of Aircraft War Production Council, Inc., East Coast. The first one was organized several months ago in California, designated Aircraft War Production Council, Inc. Satisfactory results obtained by the West Coast group is largely the impetus behind the new Eastern group.

The California coalition consists of Consolidated, Douglas, Lockheed, Northrop, North American, Ryan, Vega, and Vultee. The Eastern association is Aviation Corporation (Republic Aircraft Products, Lycoming Division (engines), American Propeller Corp.) Bell Aircraft, Brewster, Curtiss-Wright, Eastern Aircraft Division of General Motors, Fairchild Airplane and Engine, Glenn L. Martin, and Republic Aviation.

Notably absent from the Eastern Council is United Aircraft and Grumman. Guy Vaughn, president of Curtiss-Wright, and president of the Eastern Council, said he thought United would join later, and he was assured that Gruman would cooperate.

Notably **present** is General Motors, the first non-"old line" aircraft company to be officially admitted to the fold. Established aircrafters do not like the invasion of their preserves by the auto men; they fight verbally, but actual cooperation has not been withheld.

Beech Aircraft and Cessna, both of Wichita, are still outside the pools, as also are several smaller concerns like Waco, Spartan, Piper.

Donald Douglas, president of the West Coast Council, reviewing its first six months of operation, says members and some non-members have made 4,151 exchanges of materials; engineering reports on more than 1,000 subjects were swapped; likewise interchanged were listings of production machinery which could and did work for neighbors in a pinch.

Like the Western group, the East Council has committees, on engineering, production, materials, transportation, training, and other functions.

It is now plain, and in honestey should be publicly stated, that we are not going to produce 60,000 airplanes this year, as called for by the President in his message to Congress last January 6. In fact, Mr. Roosevelt has opened the way for such comment by explaining that he meant we would produce planes at the "rate" of 60,000 —not that we would turn out that many.

This is what the message said: . . . "To increase our production rate of airplanes so rapidly that in this year, 1942, we shall produce 60,000 planes, 10,000 more than the goal set a year and a half ago."

You can read that to suit yourself, but do not be dismayed because we shall not make the goal. For one thing, we will not fall very far short of it. Secondly, we are building, this year, a whale of a lot of airplanes, and perhaps 1,000 per month more right now than the entire Axis combined. Thirdly, our failure doesn't cheer the Axis at all. For they know, as well as we do that we will overshoot the 125,000 quota of 1943 by more than enough to make up the minus difference under 60,000 this year. And, though it would be a fine thing for Russia and other hard-pressed fronts if they had six or eight thousand more planes from us this new year, nevertheless, the enemy will not gain air superiority over the Channel or at any other vital point, or win the war, because we could not quite deliver the staggering bogey which the President rightly set up.

Fisher Body division of General Motors is in mass production, and three months ahead of schedule, on Sperry gyro horizon and directional gyro indicators. This is the first time, Fisher says, that a job of this kind has been undertaken by an automotive company. The work requires machining at extremely close tolerances, perfect polishing, and a high degree of cleanliness. It is understood that Sperry has licensed or subcontracted large amounts of its many aviation and maritime instruments, which Company does not have the capacity to produce. All the warring nations are racing against time to equip their planes with blind flight instruments and de-icers so they can attack in this winter's weather.

Vernijigger is the name of a new device, produced by R. K. Dundas, Ltd., of Portsmouth, England, and reported by The Engineer and British Aircraft Constructors magazine, to meet the need for a cheap and convenient means of accurately drilling and marking out jigs and fixtures or for making single components for an experimental article. It is really a cheap jig borer with accuracy equal to anything needed in normal work—a maximum permissible error of plus or minus 0.0005. It can be used with a radial drill, sensitive bench drill, hand pillar drill, moving head drill, hand pistol grip drill, or an electrically or otherwise operated hand drill brace. It can be made in a range of sizes but the standard instrument has 12-in. arms.

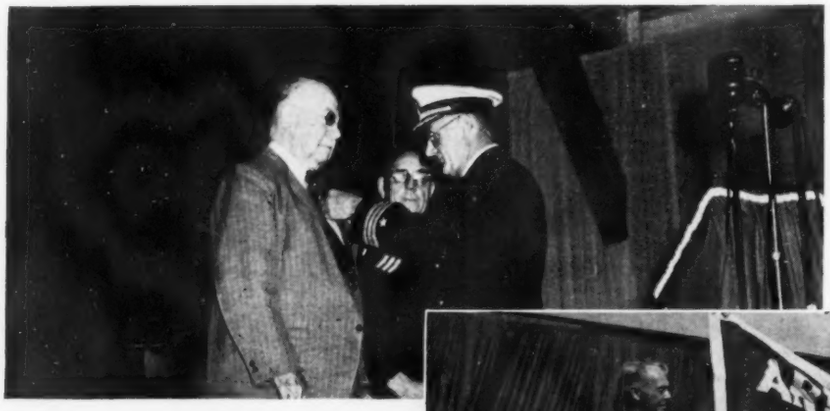
"Battleships now building are ahead of schedule by a total of 41 months." This is quoted from a recent statement by House Naval Affairs Chairman Vinson. And it clears up doubts left hanging after an appropriation for the Navy ommitted funds for new battleships. Circuitous statements at the time led many to believe, as some strategists wished, that the whole battleship program had been stopped and its steel and hours turned over to aircraft.

The pressure is still on. The aircraft industry doesn't mind Kaiser's WPB letter of intent, to build three big cargo planes, because: (1) they don't think Kaiser can show them up on either design or speed of production—if and when he gets to the production stage; and (2) he is taking very little strategic material. But, he is taking, or will take, machine tools, and still more important, he will take immediately, on design work, perhaps 1,000 engineers, or even more. These engineers will come directly out of the plants of going aircraft plants—or indirectly from training schools. Some of the aircraft builders don't like that. They need every engineer they can get to work out new planes, and to execute a constant stream of design changes, ordered from battlefronts. Regardless of whether you are pro- or anti-Kaiser, you can speculate on the possibility that, when the Manpower Commission gets the power, it could still stop Kaiser's project, (with the blessing of the Army and WPB) by ordering his skilled men onto other jobs.

TANKS AND GUNS IN LIBYA

WASHINGTON — Armored force officers returning fro mthe Libyan battle clear up the story of last summer on how the German 88 mm. guns beat the American General Grant M3 tanks. These officers report, according to the Army and Navy Journal, that the German tank guns were unable to penetrate the M3's armor. But the 88's are anti-tank guns. There is no tank that can stand up against any first rate anti-tank gun, including our own.

"E" Awards Encourage Competition Between Producers and Teamwork



CINCINNATI BICKFORD TOOL CO. president, A. H. Tuechter and John Herking, oldest employee, received the "E" pins from Com. H. G. Mosler, (left). The presentation of the burgee was made by Lt. Col. W. R. Martin. A floral tribute, in the shape of an immense "E" pin, was presented the company directors by F. J. Schmudde, employee representative.

NEW BRITAIN-GRIDLEY MACHINE DIVISION president, H. H. Pease and employee representative Bernard Blacker, hold the burgee awarded the plant by Col. Earl McFarland, (right). Hon. R. A. Hurley, Governor of Connecticut, spoke. "E" buttons were presented Blacker by Capt. A. K. Atkins, USN.

NATIONAL AUTOMATIC TOOL CO. president, Harry W. Bockhoff, received the award from Lt. Col. W. R. Martin, during a colorful open air ceremony, (left). Present on the platform were representatives of the U. S. Navy and of employees of the plant.

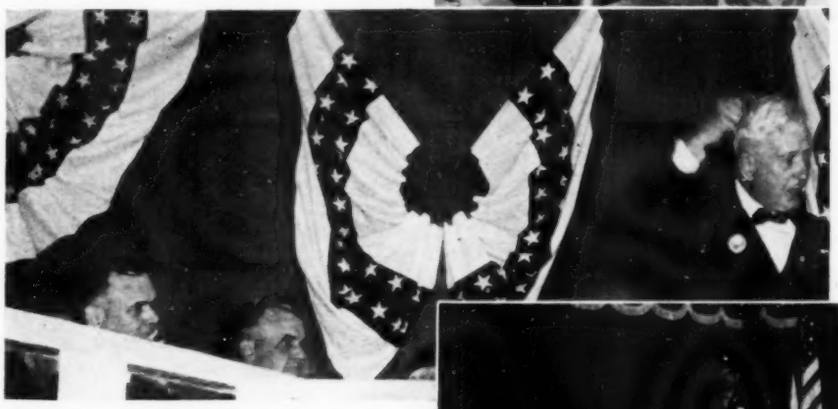
THE SHEFFIELD CORP. had as its guests during the presentation of the award (l. to r.), I. H. Jones, Henry Ochs, C. R. Curtner, Lt. Col. D. A. Lenk, Lt. Col. M. M. Osborne and Brig. Gen. L. T. Miller, Field Commander of the Air Service Command, Rev. S. L. Weems and Pauline Robbins, representing women employees. (Right)

NATIONAL BROACH & MACHINE CO. employees heard Col. A. B. Quinton, Jr., in making the award to Pres. R. S. Drummond, state, "Intelligent, humanitarian management and skilled, cooperative employees have combined to make this organization a compact, efficient unit". Lt. Com. A. F. Duernberger presented the "E" emblems to employee representative G. W. Jacobs. (Left)

Among Employees

SUNDSTRAND MACHINE TOOL CO. employees heard industrial workers lauded as the "truly unsung heroes of today", as the award was made by Brig. Gen. J. M. Willis. Present on the platform (right) were Gen. Willis Hugo L. Olson, Sundstrand president, who accepted the flag, Lt. Col. G. V. Rountree and Lt. W. R. Teller, Jr., who presented the "E" pins to employees. Judge W. R. Dusher, presided.

REED-PRENTICE CORP. president, R. E. Thompson, received the award from Brig. Gen. T. E. Troland. C. P. Howk, oldest employee in point of service, received the lapel insignia from Capt. C. J. Wheeler, USN, and exhorted his fellow-workers to continued effort, (below). Mayor W. S. Bennett made an address of welcome and Gov. Leverett Saltonstall of Massachusetts stressed the importance of continued production. H. W. Dunbar, vice president of the Norton Co., presided.



WESTINGHOUSE ELECTRIC'S Nuttall Gearing Works, Sharon Transformer Division, Derry porcelain plant and plants in E. Pittsburgh and Trafford received awards. Rear Admiral W. C. Watts made the awards during visits to each. Lt. Com. C. E. Egeler presented the lapel insignia to employee representatives. (Above)

EX-CELL-O CORP. employees stayed at their machines, to minimize "down time", while the award ceremony was broadcast over the P.A. system. Col. A. B. Quinton, Jr., presented the burgee to Phil Huber, president and general manager. Capt. E. R. Henning, USN, presented lapel insignia to William Pace, chairman, Executive Shop Committee. (Right)

AMERICAN TOOL WORKS CO. employees, management and guests gathered in a decorated section of the plant to hear Rear Admiral W. T. Cluverius make the award to company president L. W. Scott Alter. Lt. Col. W. R. Martin presented "E" pins to Mr. Alter and Herman Pottebaum, employee representative. (Left)

WPB Board of Awards Honors War Workers For Suggestions That Improve Production

WASHINGTON—"Soldiers of production" now receive official recognition under a procedure set up at War Production Drive Headquarters. Every man and woman working in a war plant is eligible for commendation in line of duty through job-improvement suggestions that will increase the rate of production, give better quality, promote safety or in any way contribute to the war effort.

Suggestions are first examined by plant Labor-Management committees. More than 1,600 such committees, representing plants employing 3,500,000 workers are now cooperating in this War Production Drive activity.

The Labor-Management committees are authorized to confer the Award of Individual Production Merit to workers making meritorious contributions to the War Production Drive. Only after production suggestions survive local examination and are found workable are they sent to Washington for final action by the Board of Awards.

Citation Is Highest

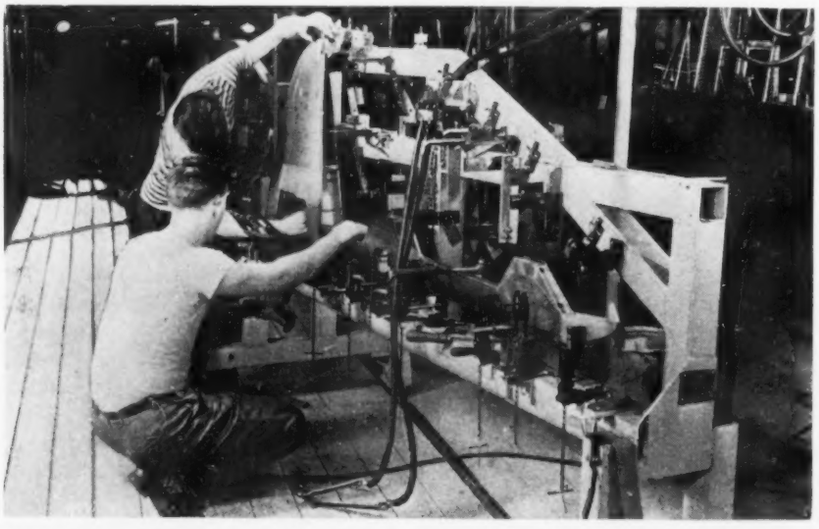
The highest honor conferred by the Board is the Citation of Individual Production Merit made only for outstanding contributions which improve the quantity or quality of weapons of war, or which conserve critical material. The Citation is considered on the production front in the same light as a military honor on the battle front.

Certificates of Individual Production Merit are the second highest of three awards for suggestions. Other suggestions that deserve recognition are given honorable mention.

The Board of Awards now consists of: Ray Millholland, engineer and writer; Dr. J. L. Bray, head of the School of Chemical & Metallurgical Engineering, Purdue University; John L. Savage, chief design engineer, U. S. Bureau of Reclamation; Whiting Williams, author, lecturer and consultant in industrial relations; Paul H. Stanley, chief engineer, Picairn Auto Gyro Co.; Charles B. Francis, chemical engineer and consultant, Carnegie-Illinois Steel Corp.; Henry C. Atkins, Jr., superintendent, E. C. Atkins Co.; Dr. Joseph Rockhoff, chief chemist, Dayton Rubber Mfg. Co.; William Plumer Hill, assistant superintendent, Bethlehem Steel Corp.; and Dr.. Robert F. Blanks, chief of the Government Testing Laboratories, Bureau of Reclamation.

Suggestions Are Publicized

The purpose of the War Production Drive award plan goes far beyond the recognition of individual workers who contribute their "know how" to the war effort. By far the greater value of the plan is the "plowback" of these practical ideas to American industry. All suggestions are publicized in brief, and further details are obtainable from War Production Drive Headquarters. Already 16 men and one woman have been given Certificates of Individual Production Merit, and 16 others have received honorable mention. No citations have yet been announced.



Three Dimensional Seeing—Painting floors in light colors increases illumination of underparts of planes under construction. The reflection factor of light gray floors is 60 percent, according to findings of the E. I. du Pont de Nemours Co. Proper painting in light, eye-restful colors will materially increase illumination without changes in lighting equipment or wattage and will give increased safety and efficiency

TOOLMAKERS IN THE AEF —RSVP

COVENTRY—United States soldiers in England, who in private life had been employees of machine tool firms, will be entertained by Albert Herbert, Ltd. This firm is the English sales representative of many United States machine tool builders. In letters to each of the latter, the Herbert firm wrote, "If you could put us in touch with them we should like to do what we can to give them some hospitality and make their stay in this country a pleasant one". They concluded with a request that they also be advised of the names and whereabouts of employees of any other machine tool firms for whom they are not sales agents, for "we should like to do what we can for them in just the same way".

Revised Reporting Plan For Machine Tool Builders

NEW YORK—A revised plan for reporting order boards is to be instituted November 1 by the WPB, according to George C. Brainard. Accordingly, the tool builder will fill out a card for each machine tool ordered. The card has an identifying number which he thenceforth incorporates in his records. From then on, he reports changes in the status of his orders, shipments, cancellations, diversions or rescheduling, by simply referring to the identifying number. To further simplify procedure, WPB has prepared a form which can be used both as a report of change of status to the WPB and as a report to the customer of change in delivery date.

Washington Appointments

WPB, Miscellaneous:

Thomas R. Armstrong chief of the Foreign Requirements Liaison Branch; Col. Charles R. Baxter, Ordnance Dept., U. S. Army, chief of the new Materials Redistribution Branch; Carman G. Blough, chief, Contract Review Branch, Procurement Policy Committee; Dan W. Turner, chief, Prison Industries Branch, Bureau of Governmental Requirements; Donald D. Davis, director of the newly created Program Coordination Division; A. W. Thomas, consultant for the Construction Machinery Division; Matthew Woll, AFL, and Phillip J. Clowes, CIO, advisers to Smaller War Plants Division; Frank Prince, chief loan agent, and Golden W. Bell, attorney for Smaller War Plants Corp.; Col. Bradley Dewey, deputy rubber director.

BUSINESS ITEMS

Standard Machinery Co. is the newly adopted name of the Standard Tool Co., 3115 West Broad Street, Columbus, Ohio. The change has been made to eliminate confusion with another firm of the same name in another city.

Blanchard Machine Co., 64 State St., Cambridge, Mass., manufacturers of surface grinding machines, has appointed as its representative for Connecticut, eastern New York and northern New Jersey, the Rudel Machinery Co., with offices in New York City and Hartford.

The Independent Pneumatic Tool Co., manufacturers of Thor pneumatic and electric tools, has announced the appointment of Mr. Vance G. Turner as Boston branch manager and the removal of that office to 78 Brookline Ave. Their Birmingham, Ala., office has moved into its own new, modern home at 1411 N. Third Ave.

Smith Tool & Engineering Co. is the new corporate name of the Smith Tool Works, Inc., of Bucyrus, Ohio. Having perfected a special process for developing flat surface plates and allied equipment, they recently introduced the Smith Master Surface Plates. The name Smith Incubator Corp. will be retained as a subsidiary of the parent company, and its activities confined solely to the sale of incubators.

OBITUARIES

Wilbur L. Gourley, president of the Lehmann Machine Company, died recently.

EDWARD H. THOMAS

Edward H. Thomas, manager of the New York office of Farrel-Birmingham Co., died recently following a heart attack. Mr. Thomas was widely known in both the cane sugar and marine industries for his knowledge of the design and operation of equipment used in those fields.

1000th Thread Grinder — Jones & Lamson Machine Co. officials pose with the 1000th monument to their faith in precision thread grinding. From l. to r., R. E. Flanders, president, E. V. Flanders, manager, thread grinder department, Lee Davis, engineer, and Walter Grimm, manager, thread tool division

Roy Hunter, direct sales representative in the Northern Ohio and Western Pennsylvania area for Gisholt Machine Co., died recently at the age of 54. He had been for years identified with the machine tool industry, including a long association with International Machine Tool Co., prior to his becoming a member of the Gisholt field sales personnel, two and one-half years ago.

EDWARD W. P. SMITH

Edward W. P. Smith, 56, consulting engineer for the Lincoln Electric Co. and a nationally known authority on arc welding, was found dead recently in his berth aboard a train on which he was returning to Cleveland after having addressed a meeting of the American Welding Society at Indianapolis. Mr. Smith, had been for more than 20 years with the Lincoln Electric Co., and during the last year had traveled extensively to advise manufacturers in the use of welding and to conduct courses and give lecturers on the latest technique.

Michael O'Hayer, 75, general superintendent of the North & Judd Mfg. Co. for 20 years before his retirement in 1940, died recently.

Francis G. Echols, 88, formerly president of the Greenfield Tap & Die Co., died recently, after a year of illness. He had retired as president of the tap and die company in 1932. Previously he had been manager of the small tools department of the Pratt & Whitney Division of Niles-Bement-Pond Co. for 25 years.

NAMES in the NEWS

Ray Lawson has resigned as president of Federal Aircraft, Ltd., to become chairman of the board. He is succeeded as president by W. A. Newman, managing director of the company since 1941. Mr. Lawson resigned to devote more time to his duties as head of a lithographing and engraving firm and as a director of the Royal Bank of Canada.

Charles C. Chamberlain has been named general sales manager of Jenkins Bros. Mr. Chamberlain had been publicity manager of the company since 1940, and prior thereto was advertising manager since 1932.

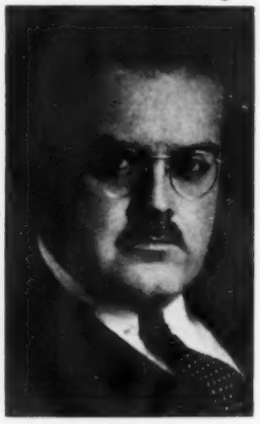
A. O. Thalacker has been appointed general manager of the Detroit Rex Products Co. He has been a company executive for the last five years and lately has been secretary, a position he retains in addition to his new responsibility.

The election of Howard D. Grant as president and Stevens H. Hammond as executive vice president of Whiting Corp., was announced following a meeting of the board of directors. Mr. Hammon will also serve as chief of the executive staff; serving with him on the executive staff will be D. Polderman, Jr., formerly in charge of the New York district office, who will specialize in sales and customer service, and H. D. Grant, president. R. Elliott Maxwell has been appointed vice president. He will supervise the sales force in the eastern half of the country.

Landis President

C. N. KIRKPATRICK

American Welding Head



WILLIAM J. SAMPSON

C. N. Kirkpatrick, vice president and general manager, Landis Machine Co., has been appointed president of that company. He will continue his duties as general manager. G. M. Stickell, sales manager, has been advanced to vice president, and will continue his former duties.

Clarence E. Shiplet, superintendent of erection and machining at the Louisville Division of the Westinghouse Electric and Mfg. Co., has been awarded the Westinghouse Order of Merit for distinguished service. The award was based on "his ability to organize relatively unskilled workers into a trained and enthusiastic team capable of assembling equipment of extreme accuracy of workmanship; for his technical ability and judgment in handling difficult factory problems; and for his devotion to the interests of the company".

James G. Johnston, superintendent of the Endicott, N. Y., factory of the International Business Machines Corp., has been appointed general works manager for all the company's plants in Endicott, Washington, D. C., Rochester and Poughkeepsie, N. Y. He will be succeeded at Endicott by William L. Lewis, who was previously his assistant. Frank H. Welsh, Jr., has been appointed supervisor of factory training program at all of the company's plants.

D. L. Immel has been promoted to assistant plant superintendent of the Copperweld Steel Co. plant at Warren, Ohio.

Harold A. Wilson, former sales representative for the Drive-All Mfg. Co. in Chicago, has recently been advanced to the position of manager of the Chicago district. Mr. Wilson succeeds J. Ralph Griffith who has been made general sales manager for the factory and the home office.

William J. Sampson, Jr., has been named president of American Welding and Manufacturing Co. He was formerly general manager of sales for the Steel and Tube Division of Republic Steel Corp.

Fred C. Tanner, vice president and formerly manager of sales and engineering, Federal Products Corp., has been advanced to general manager of that company. Mr. Tanner was at one time development engineer on new inspection, quality control and production at Western Electric Co., in Chicago, and later chief inspector of radio and general manufacturing, General Electric Co., Bridgeport, Conn.

Harold V. Coes, vice president of Ford, Bacon & Davis, Inc., was elected by a letter ballot to be president of the American Society of Mechanical Engineers during 1943. Vice presidents elected at the same time to serve two-year terms on the Council of the A.S.M.E. were Joseph W. Eshelman, president, Eshelman & Potter, Thomas E. Purcell, general superintendent of power stations, Duquesne Light Company, Guy T. Shoemaker, vice president, Kansas City Light & Power Co., and Walter J. Wohlenberg, professor of mechanical engineering, Yale University. Managers of the Society elected to serve on Council for three-year terms include Roscoe W. Morton, professor of mechanical engineering and head of the department, University of Tennessee, Alexander R. Stevenson, Jr., staff assistant to vice president, General Electric Co., and Albert E. White, director engineering research, University of Michigan.

Warren K. Lee has been elected vice president of the Wilkening Manufacturing Co. He has been a member of that organization for over ten years, in charge of the sale of piston rings to the manufacturing or original equipment market.

Herbert J. Burgess has been appointed general superintendent in charge of all manufacturing at the Westinghouse Electric and Mfg. Co. East Springfield plant; he had been superintendent of the plant's feeder division since 1937. Thomas O. Armstrong has been appointed manager of the industrial relations department of the same plant; he will direct the plant's employment, safety, health, recreation, job analysis and service activities. A. E. Hitchner, former manager of the company's Los Angeles office, has been appointed assistant to the manager of the industry sales departments.

MEETINGS

American Gear Manufacturers Association. Semi-annual meeting. Skytop Lodge, Skytop, Pa. Oct 15-17.

American Management Association, two-day conference on war production problems, Hotel New Yorker, New York, N. Y., Nov. 10-11.

American Society of Mechanical Engineers, 63rd annual meeting, Hotel Astor, New York, N. Y., Nov. 30-Dec. 4.

American Society of Tool Engineers. Semi-annual meeting. Kimball Hotel, Springfield, Mass. Oct. 16-17.

American Welding Society. Annual meeting. Hotel Cleveland, Cleveland, Ohio. Oct. 12-16.

National Association of Manufacturers, Waldorf Astoria Hotel, New York, N. Y. Dec. 2-4.

National Electrical Manufacturers Association. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. Oct. 26-30.

National Exposition of Power and Mechanical Engineering. Madison Square Garden. Nov. 30-Dec. 4.

National Founders Association. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. Nov. 18-19.

National Metal Congress and Exposition. War Production Edition. Cleveland Public Auditorium. Oct. 12-16.

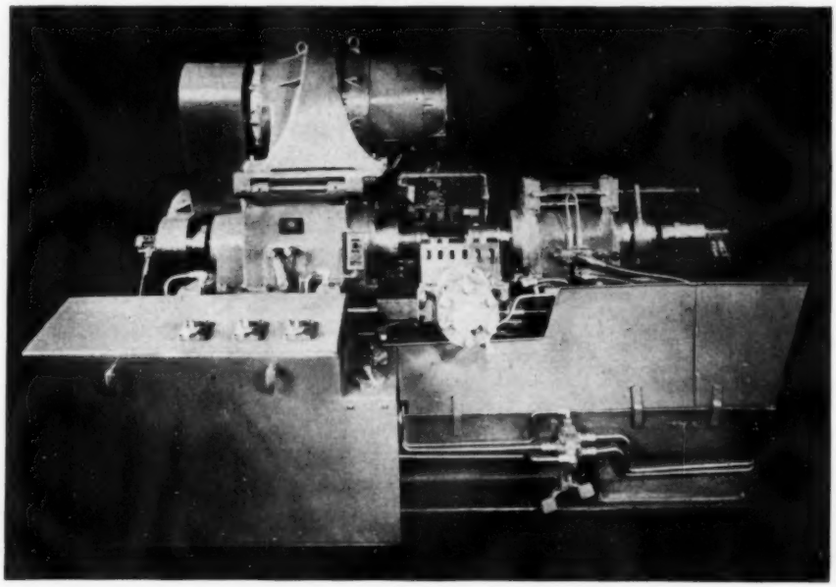
National Safety Congress and Exposition, Hotel Sherman, Chicago, Ill. Oct. 27-29.

Society of Automotive Engineers, National fuels and lubricants meeting, Tulsa Hotel, Tulsa, Okla. Oct. 22-23.

Wire Association. Annual meeting. Hotel Carter, Cleveland, Ohio. Oct. 12-17.

SHOP EQUIPMENT NEWS

Sparks Semi-Automatic Cylinder Turning Lathe Developed for Turning Heavy Airplane Cylinders

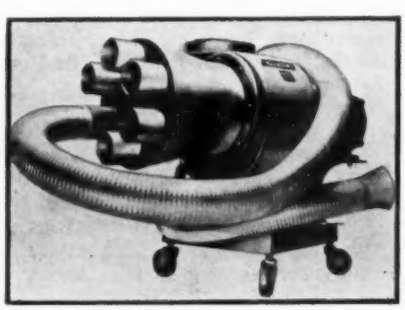


Announcement has been made by Sparks Machine Tool Corp., 32 Main St., Norwalk, Conn., of a semi-automatic cylinder turning lathe especially for the turning of heavy airplane cylinders. The machine will accommodate six turning tools on the front cross-slide for the main body turning, using a cartridge toolholder mounted on the cross-slide and operated hydraulically. The back toolholders with six tools are mounted on the back slide, which also moves in and out of the work automatically. The holding mandrel is designed to grip the cylinder on both ends.

The headstock, having roller and ball bearings throughout, has four selective speeds for the turning of the different size airplane cylinders. To slow down these speeds when turning exceptionally hard cylinder material the motor is equipped with reducing gears.

A roller bearing quill expanding arbor is fitted to the quill and is expanded automatically by operation of a separate hydraulic cylinder attached to the end of the quill. The quill is traversed backward and forward by connection with a hydraulic cylinder mounted on the top of the tailstock.

The feeds are all controlled through metering valves which are located on the front of the lathe convenient to the operator. The holding equipment is operated through a foot treadle valve which is located on the front of the machine, allowing quick recovery of the finish turned cylinder and for rapid gripping of a new rough cylinder to be turned. The approximate weight of the lathe is 13,800 lb.



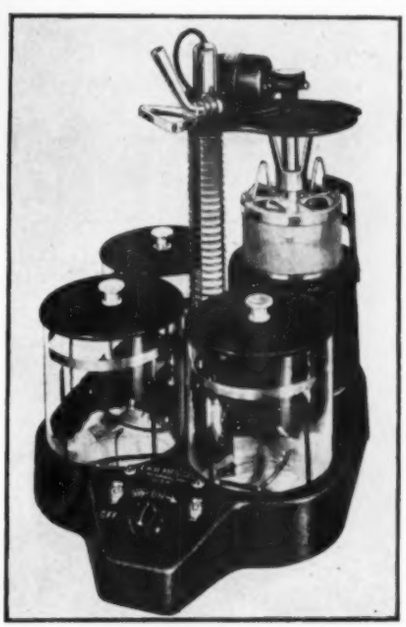
Chelsea Octopus Exhauster ← Also Serves As Ventilator

Chelsea Fan & Blower Co., 1206 Grove St., Irvington, N. J., has brought out an exhauster and ventilator called the Octopus which is suitable for welding departments. This unit may be placed or hung in any convenient place between the working area and the open air. Flexible metal hoses connect it to the area to be ventilated.

The Octopus is operated by a heavy-duty ball bearing motor equipped with overload protection. Especially designed blower wheels have been developed for the unit. By simply changing the position of the tube adapter the exhauster can easily be converted into a fresh air ventilator. One to six of the nozzles can be used as desired, and caps are provided for those not in use.

L & R Cleaning Equipment Does Small Parts Cleaning

For cleaning, rinsing, polishing and drying small, delicate parts such as aircraft instruments, gages, bearings, telegraphic equipment and meters the L & R Manufacturing Co., 54-56 Clinton



St., Newark, N. J., has introduced a heavy-duty precision cleaning machine. It has three Pyrex jars of 1½ gal. capacity, 7 in. inside diameter and 9 in. deep with covers made of aluminum, and a cleaning basket which snaps into position on the motor shaft. The center bar on which the motor is mounted properly positions the basket over each solution jar and the drying chamber. The work basket is made of monel and monel mesh, 5½ in. inside diameter and 3⅜ in. deep. The shaft which lifts the basket has an oil-seal spring for ease of operation.

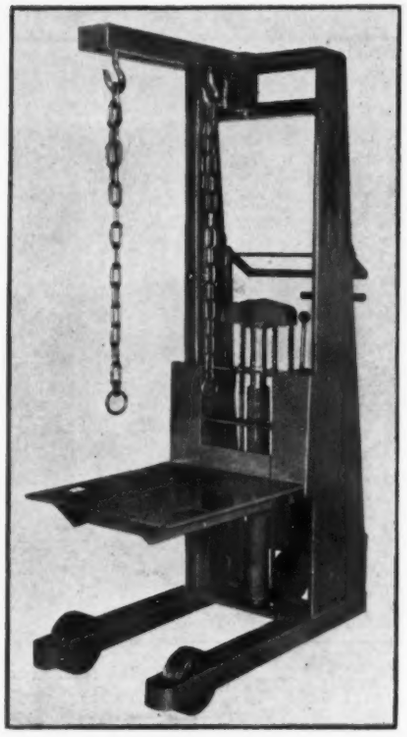
The basket is first lowered into the cleaning solution jar which contains L & R Nofome cleaner. A rheostat on the base of the machine is used to

regulate the motor speed. After running in the cleaner solution the motor is cut and the basket raised in the jar above the liquid level and again rotated to throw off excess solution. These operations are then repeated in the second and third jar which contain the rinsing solution, and finally the basket is placed over the drying chamber which contains a separate motor and fan in conjunction with a heater unit.

The net weight of the cleaning machine, with solutions, is 41½ lb. and it occupies a space 17¼×16½ in., with overall height of 23 in.

Lyon Die Handling Truck Serves As Crane or Stacker

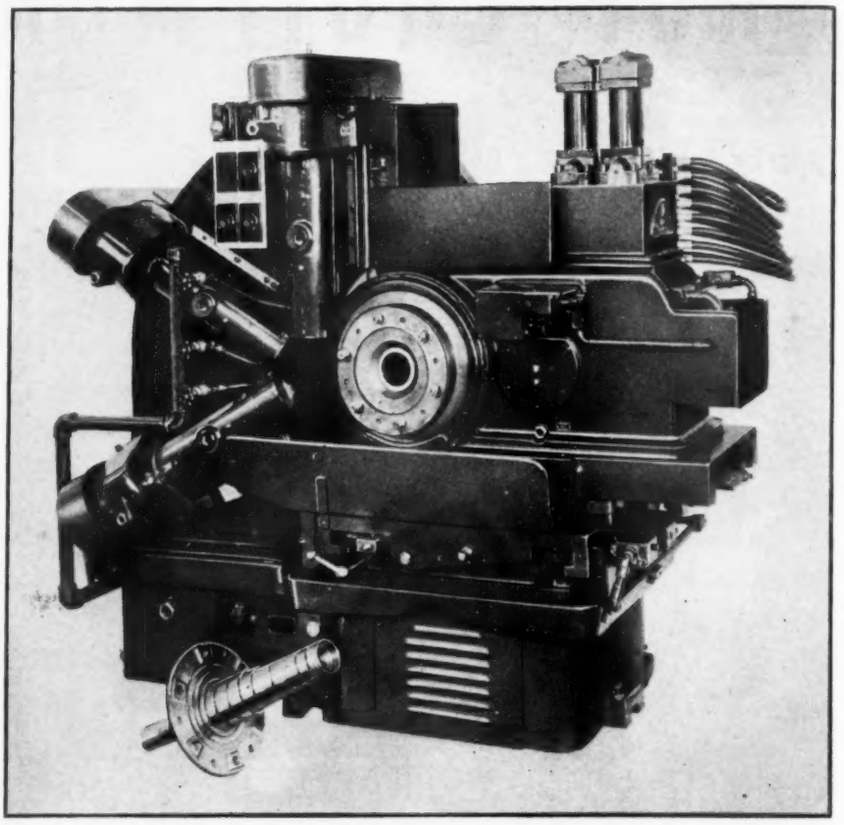
A die handling and stacking truck which has many applications by change-over in a few seconds has been brought out by Lyon-Raymond Corp., 1049 Madison St., Greene, N. Y. By use of the platform skid loads of dies, lifting and stacking of barrels and other materials can be handled. When the platform has been removed and



the boom attached to the carriage frame, the truck serves as a crane for picking up dies from the floor and placing them on skids. With the boom in position on top of the frame and the platform in position on the truck carriage, with skid and die in elevated position, the truck may be used for separating dies.

The overall height of the truck is 94 in. and it has a capacity of 1,000 lb. The platform measures 25 in. wide by 30 in. long. The unit is equipped with a floor lock for holding the truck in position.

Snyder Three-Spindle Rotary Milling Machine Mills Undercut in Circular Shoulder of Shaft Hub



For use in milling an undercut in the circular shoulder section of a turned airplane propeller shaft hub to produce six elevated rest pads the Snyder Tool & Engineering Co., 3400 E. Lafayette St., Detroit, Mich., has produced a three-spindle rotary milling machine. With the work piece loaded and clamped in position hydraulically, the first cycle starts with the entire fixture assembly and work piece moving automatically by hydraulic power along the main slide into milling position.

A transverse sub-slide then brings the work piece into contact with the tools and feeds it forward until the required cutting depth is reached. The piece is then rotated through the specified cutting arc. The tools have tapered shanks and because of their small size are supported by an outboard bearing.

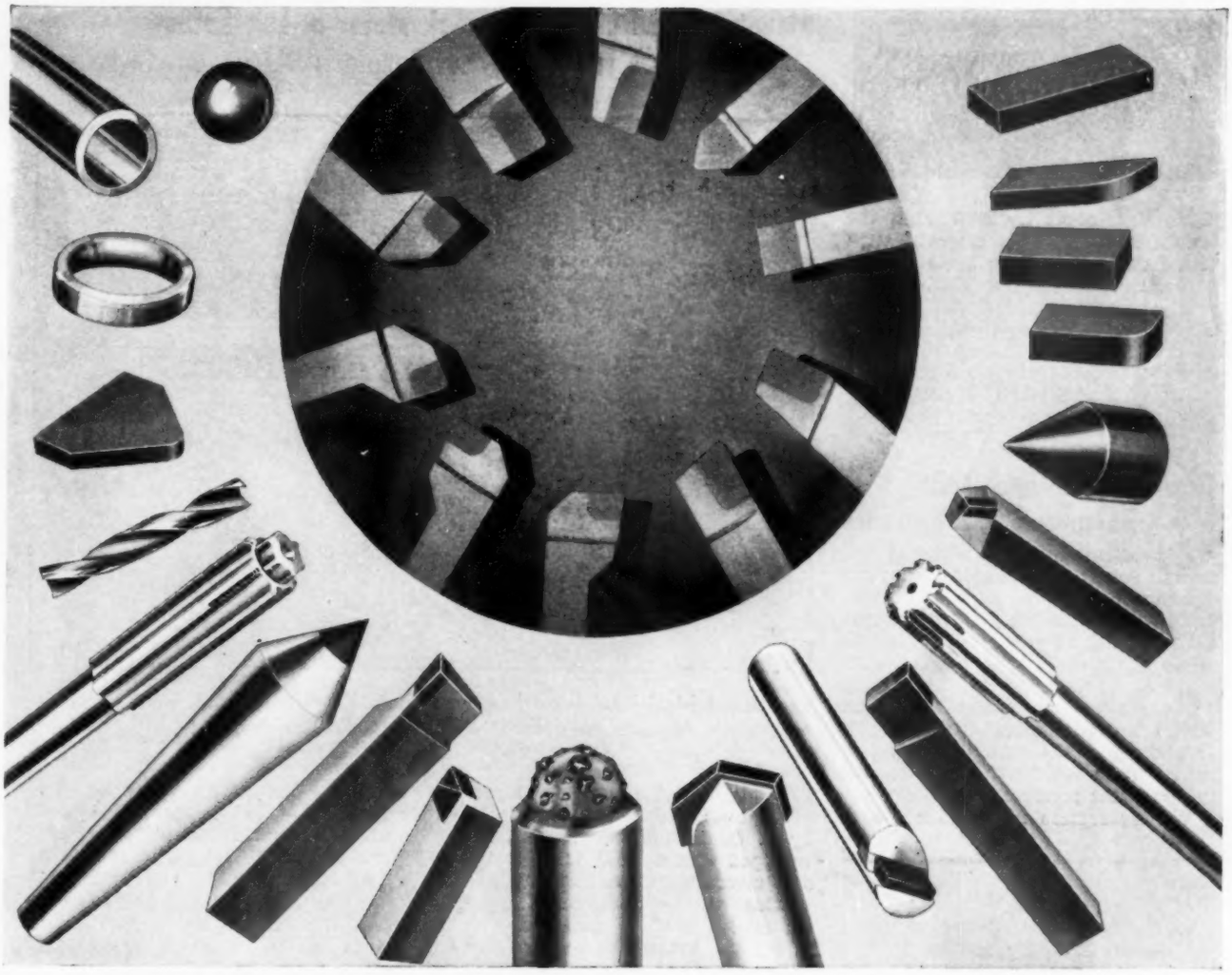
The fixture retracts and rotates the work piece 180 deg., on completion of the first three cuts, into position for the second three cuts. When the six rough cuts have been made, the fixture again retracts and the entire fixture assembly moves along the main slide. After throwing a lever which starts the machine through an identical second cycle the finish cut is made. Indexing is automatic, and the rotation of the fixture during the milling cycle is accomplished through heavy-duty hydraulic cylinders which give an adjustable feed rate for milling.

Magnaglo and Zyglo Methods Produce Visible Flaws in Metals

For inspecting magnetic and non-magnetic metals the Magnaflux Corp., 5908 Northwest Highway, Chicago, Ill., has recently introduced methods known as Magnaglo and Zyglo.

By fluorescent indications under black light inspection significant discontinuities in magnetic metal parts are revealed in the Magnaglo method. Parts to be inspected are first properly magnetized by means of a suitable standard Magnaflux unit. When the piece is properly magnetized, defects cause areas of local flux leakage. Next, special Magnaglo indicating materials are applied to the part. The particles are drawn into and held by the leakage fields, producing a visible accumulation along the defect which is highly visible under "black light." Speed of inspection is stepped up by the neon-like glow produced in this method.

For non-magnetic metals not within the scope of Magnaflux inspection the Zyglo method has been developed. Indications similar to those secured with Magnaflux are seen as lines of fluorescence visible under black light. The fluorescent markings coincide with discontinuities at the surface and are made primarily by penetration of the



ANNOUNCING—NEW, STOCK-TOOLS AND BLANKS *plus* NEW, TIME-SAVING STANDARDIZED DESIGNS!

Carboloy Company now makes available (effective Sept. 8) a large number of additional *STANDARDIZED* tools and blanks, to supplement its present standard boring, facing and turning line.

These newly standardized tools and blanks fall into two classifications as follows:

1. Standard *STOCK*. Standard stock items are those manufactured in mass production and maintained in stock for immediate requirements. With the additional standards established, over 200 separate items are now in this standard stock classification.

2. Standardized Designs. Standardized-design items, in general, are former special tool styles for which there previously has been a large demand ***within a narrow range of minor design variations.*** Standard designs for these have been established to broadly meet most previous requirements. You can now order these items simply by tool number and eliminate considerable time for drafting, blueprints, quotations, detailed ordering etc. Standardized design items will be added to stock as demand justifies.

A new 28-page general tool catalog, No. GT-142, contains complete prices and specifications. Copies on request.

Send for Free Catalog NOW!

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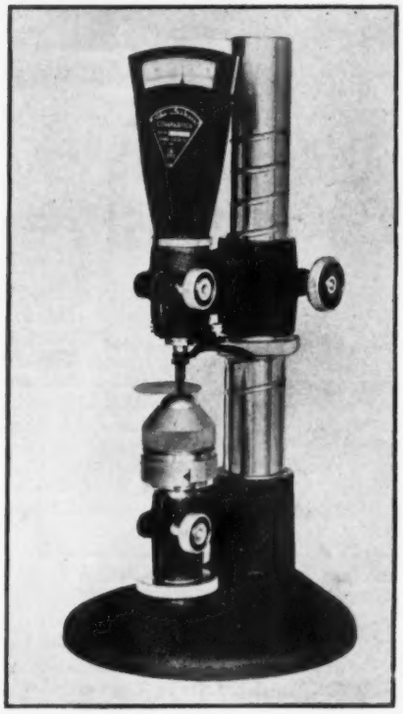
CORE BITS - MASONRY DRILLS
- WEAR RESISTANT PARTS -
FOR THE MANUFACTURING · MINING · TRANSPORTATION · CONSTRUCTION INDUSTRIES

highly fluorescent liquid through the surface openings. Four essential steps in the operation of the Zyglo method for detecting open surface flaws are the penetrant application, rinsing, powder application and observation under powerful "black light" units in a darkened booth. A Zyglo black light installation will eliminate discards and rejects of parts at subsequent stages.

Scherr Ball Measuring Anvil Eliminates Shim Distortion

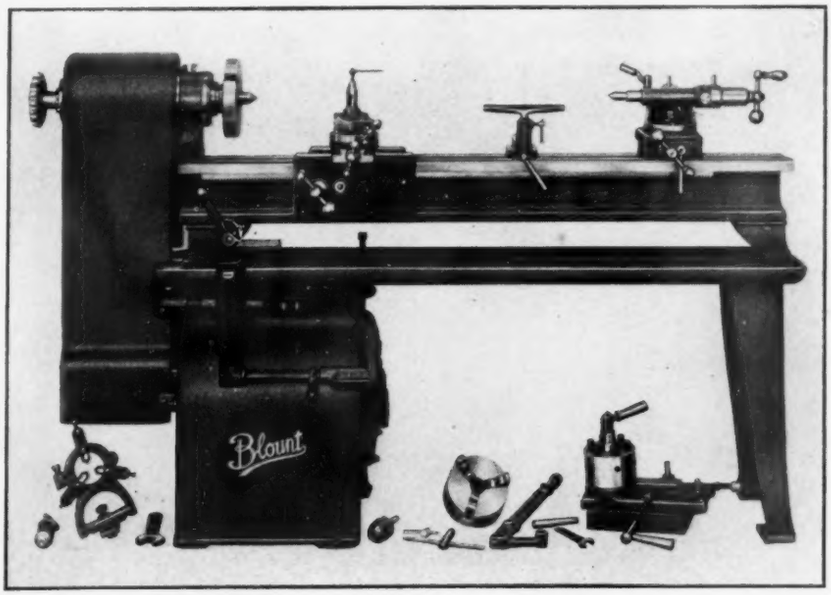
Announcement has been made by the George Scherr Co., Inc., 128 Lafayette St., New York, N. Y., of a ball measuring anvil for use on the Scherr Comparitol which is designed for accurately measuring thin work. The work is placed between the flat feeler point and the round ball surface. The use of this ball anvil eliminates distortion or bending of the shim or lamination out of size a few ten-thousandths due to measuring pressure.

Another feature is that the use of



the ball anvil on the Comparitol serves to check the flatness or parallelism of long thin pieces in all positions and on all parts of the work. When the Comparitol column is used with this ball anvil it is provided with an index line to line up accurately the ball point and feeler point from left to right as to center distance.

Blount Ball Bearing Headstock Motor-in-Leg Lathes Have Reversing and Fuseless Disconnect Switches

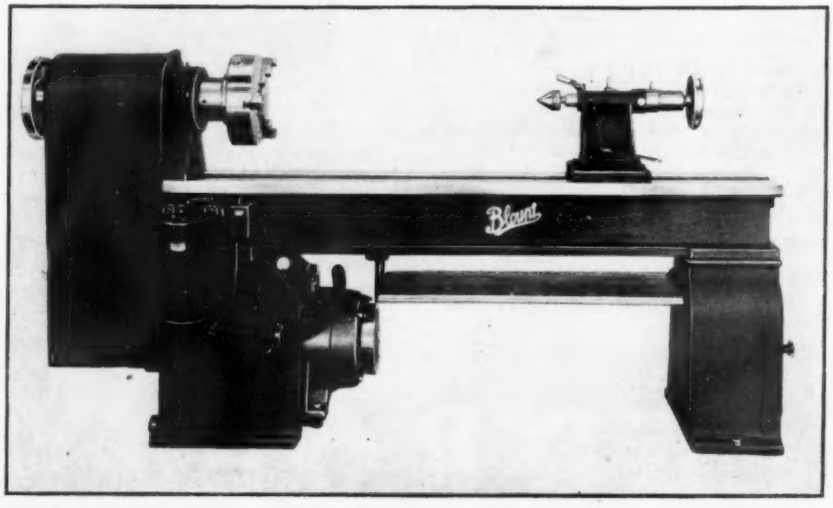


The Blount Model B-4 lathe has the spindle fitted with hand wheel drawn-in mechanism to accommodate Rivet No. 6 collets, or their equal, 1/8 to 1 in.

A Model B-3 ball bearing headstock motor-in-leg lathe has been introduced by J. G. Blount Co., Everett, Mass., equipped with 4-speed drum controller and reversing switch mounted on the outside of the headstock leg. This model can also be equipped with a ¾ hp. 300, 450, 600 and 900 r.p.m. ball bearing 4-speed motor headstock, or 300, 600, 900 and 1,800 r.p.m. for all standard voltages.

Other specifications include maximum hole in spindle up to 2½ in., bed 10¾×9½ in. deep with 3 in. wide slot, lathe chuck 12 in. size, with safety locking screws. The machine has a 20 in. swing by 8 ft. bed, with reduction geared motor mounted on an adjustable hinged motor bracket and belted on the head, spindle speeds of 41 to 421 r.p.m. Belt and hinged belt guard furnished. Net weight is 2,165 lb.

The Model B-4 has a 4-speed drum controller and magnetic starter with pushbutton and fuseless disconnect switch, ½ hp., 11 in. swing by 6 ft. bed, ball bearing headstock, 575, 850, 1,125 and 1,725 r.p.m. This lathe also has a reduction geared motor mounted on adjustable hinged motor bracket and belted to the head, for spindle speeds of 183 to 1,356 r.p.m. It is equipped with hand-feed carriage and compound rest, also full set-over swivel tailstock, belt and belt guard and shifter. The net weight of the Model 4 is 1,375 lb.



The Blount Model B-3 lathe can be furnished with an electric solenoid brake. The spindle nose is 3½ in. in dia. with six V-threads per inch

WAR PRODUCTION- 33½ HOURS PER DAY!

SUNOCO EMULSIFYING CUTTING OIL

increased output 40%...stepped up tool life...improved finish

It takes bullets to win battles, and American ingenuity is finding ways to set amazing records in the race for arms production.

For example, in a plant turning out bullet-assembling machines, excess heat on tools and work, poor finish, and operators' skin complaints were restricting production. A Sun Oil Engineer — one of those capable Doctors of Industry — was called in to improve conditions. He recommended a change in cutting fluid . . . to Sunoco Emulsifying Cutting Oil. Now they're using Sunoco . . . and rate of production has increased 40% — equivalent to an extra 9½ hour shift every day! Finish has also improved, and skin trouble vanished.

Sun Doctors of Industry and Sunoco Emulsifying Cutting Oil stand ready . . . willing . . . and able to help you step up production in your shop. For helpful case histories of what they have accomplished for other leaders in the metal working industry, write for your free copy of "Helping Industry Help America."

SUN OIL COMPANY • Philadelphia

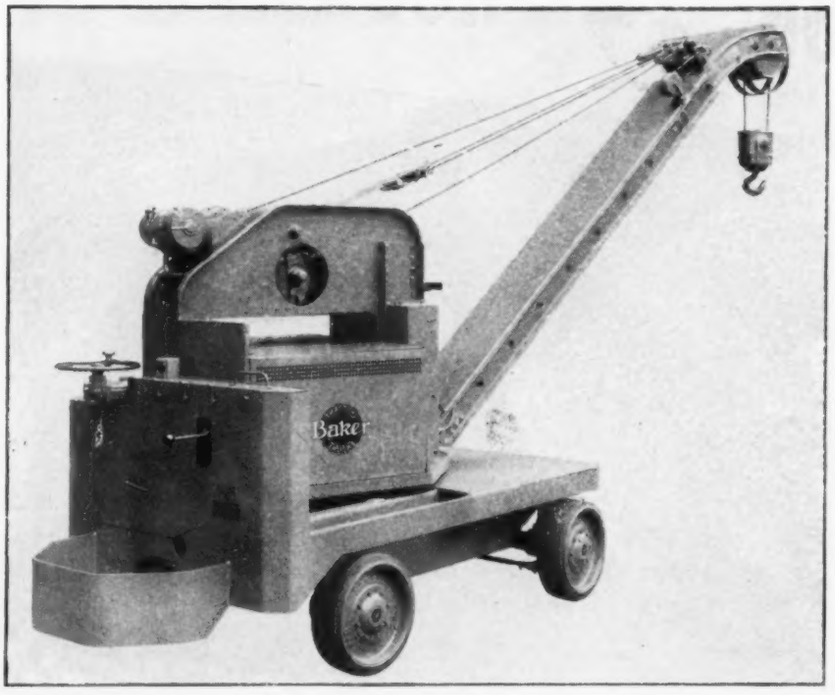
Sun Oil Company, Ltd., Toronto

LET'S GO! U.S.A. KEEP 'EM FLYING!

SUNOCO

SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

Baker-Raulang Heavy-Duty Locomotive Type Crane Truck Meets Wartime Need in Handling Heavier Unit Loads



Announcement of a locomotive type crane truck, Type CXF, with 10,000 lb. capacity has been made by Baker-Raulang Co., Baker Industrial Truck Div., 2168 W. 25th St., Cleveland, Ohio, to meet the need in handling heavier unit loads occasioned by the war production program.

It supplements the overhead traveling crane and two or more units can work in the same bay, passing each other. All controls are conveniently located on the dash and do not swing with the superstructure, permitting operators to do more work in a given time. Safety of operation is assured because the bridging over the top of the battery compartment is closely spaced so that the operator may look along either side without difficulty.

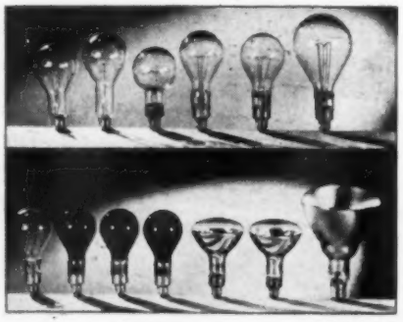
The mast on which the superstructure slews is a tall member giving two widely separated points of bearing which results in low bearing loads. This mast height permits a higher position for the topping cable idler sheaves. The slewing power is provided by a pinion meshing with the bull gear mounted underneath the superstructure. A compound motor maintains uniform speed, whether empty or loaded, and the magnetic brake insures prompt stopping.

The NoPlug travel controller has three speeds forward and reverse. Electric interlock with contactor and brake pedal automatically opens the circuit when the brake is set. The circuit can be closed only with the brake released and the controller in first-speed position, thus providing protection against accidental starting.

Wabash Infra-Red Heat Lamps Produced in Three Types

A new line of infra-red heat lamps brought out by Wabash Appliance Corp., Birdseye Div., 345 Carroll St., Brooklyn, N. Y., includes six clear types, three ruby types and four reflector types. Built-in reflector linings of pure silver, sealed inside the bulbs for protection against dimming and tarnishing by fumes or dirt, feature the reflector types. All the lamps contain the M-type tungsten filament for uniform heat distribution and have their bases reinforced with asbestos-lined mechanical straps to withstand the temperatures of tunnel installations.

These heat lamps produce infra-red and near infra-red rays that are converted into a deeply penetrating kind of heat as soon as they strike the object. The rays penetrate deep into the surface films of lacquers, paints and enamels to start the baking process from the inside out instantly and uniformly. The lamps are lightweight and are as easy to use as regular light bulbs.



Adams Fire, Gas Extinguisher Acts as War Gas Decontaminator

A fire and war gas extinguisher has been announced by O. H. Adams Co., 2018 E. Thomas Ave., Milwaukee, Wis. It acts as a decontaminator for chlorine, phosgene and chloracetophenone or tear gas, and combats automotive, airplane, industrial and marine fires. The extinguisher is also effective for plant fires, cleaners, gasoline, paint, oil and grease fires. The product is non-injurious and lasts indefinitely. It is available in 1 lb. tubes and in a 3 lb. size.

Knu-Vise Develops L-Clamp Fitted With Non-Slipping Caps

For holding L-sections in aircraft construction work an L-clamp has been developed by Knu-Vise, Inc., 16891 Hamilton Ave., Detroit, Mich. The device is practical in limited spaces or where large throat capacity is necessary. The handles are at right angles to the clamping position and the clamp can be placed in any position without projecting into space as an obstruction. Slipping of the clamps and the marring of highly polished surfaces are prevented by the rubber caps on the contact places.

Simple Operation Features Acromark Hand Bench Marker

A No. 926 hand operated marking machine that handles several hundred shell noses per hour is offered by the Acromark Corp., 9-13 Morrell St., Elizabeth, N. J. A simple swing of the hand lever rotates the part and rolls the mark in accurately to a predetermined depth. The cast iron hollow base incloses a reduction gearing to the

IN OTHER YEARS, production machinery had a comparatively easy time of it — even for this country, birthplace of mass production. But nowadays, plant equipment is subjected to extremely heavy intermittent loads, hums faster than in any peacetime period, without letup.

To keep the nation's war production moving at top speed around the clock, tougher materials had to be developed... many machine parts redesigned. But the only "change" industry required of the Torrington Needle Bearing was its conversion to war production. In the heavy-duty machinery of America-at-war, this unique bearing is again proving its adaptability — in applications where its definite advantages mean more than ever.

Its low coefficient of friction is assuring smooth performance... its high capacity and efficient lubrication are reducing the need for replacement or maintenance attention, enabling management—through steadier production —to turn out greater quantities of war equipment. From the standpoint of the machine builder, the Needle Bearing's small size, saving space and critical materials, and its remarkable ease of installation, cutting assembly time, mean faster delivery of production machinery to wartime assembly lines.

And so it is easy to see why the Needle Bearing was one of the first machine parts to "change over" and why, too —with the war production program increasing in volume and intensity — no further change has been necessary.

IN ADAPTING *the advantages of the Needle Bearing, the experience of Torrington's Engineering Department is at your disposal. Information on capacities and sizes is given in Catalog No. 105. We invite you to write today.*

THE TORRINGTON COMPANY
TORRINGTON, CONN., U. S. A. • *Est. 1866*
Makers of Needle and Ball Bearings

New York Boston Philadelphia Detroit
Cleveland Seattle Chicago Los Angeles
San Francisco Toronto London, England

TORRINGTON NEEDLE BEARING

Every feature fills a wartime need

hand lever and a gear rack arrangement to rotate the part to be marked in perfect unison with the straight line interchangeable type holder.

This holder is placed at an angle on the accurate slide with adjustable gibs and in operation a smooth slide movement rolls the straight line characters into the tapered part. One or two lines can be marked without distortion of the mark and without undue effort on the part of the operator. Mandrels can be interchangeable for different sizes of parts, and a double screw arrangement at back of the type holder slides it forward or backward for marking depth.

This machine is used for marking steel, aluminum, zinc and brass parts and requires no electric power to operate.

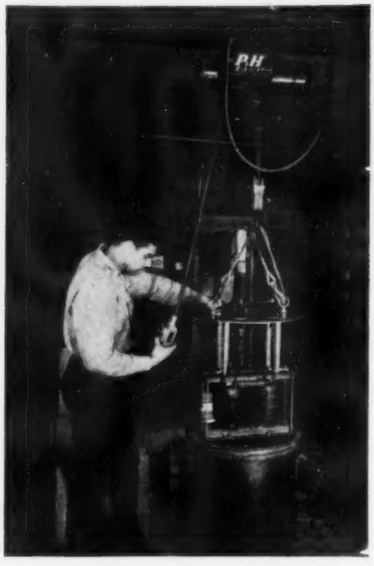
G. E. Portable Voltmeter Measures Corona Voltage

An electronic crest voltmeter designed to measure ignition voltages of internal combustion engines, surge voltages and other repeated-impulse voltages up to 30,000 volts has been announced by General Electric Co., Schenectady, N. Y.

The unit is portable and suitable for field measurement, such as trouble shooting and determination of actual operating conditions, and can be used for testing aircraft engines in flight. It has a self-contained battery power supply and can be moved readily to any location for testing purposes. To provide resistance to vibration the voltmeter is equipped with an aircraft-instrument movement. This unit can be supplied marked and calibrated for scale ranges up to 10,000, 20,000 or 30,000 volts. The weight of this voltmeter is 23 lb.

Harnischfeger Zip-Lift Hoist Made for One-Ton Capacity

A one ton capacity Zip-Lift hoist has now been made available by Harnischfeger Corp., Milwaukee, Wis. It is equipped with full magnetic pushbutton control, pre-formed non-spinning hoist cables, three-way interchangeable



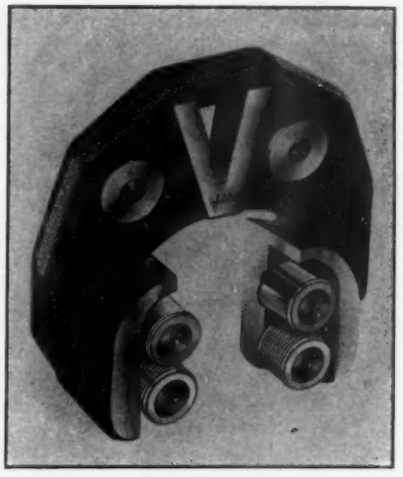
mountings, double brakes, safety type limit switch and duct- and weatherproof fully inclosed construction. The hoist is designed for quick interchangeability of mounting, trolley, hook, rigid or bolt, and can also be parallel or cross mounted.

Sylvania Makes Blackout Lamp Which Emits Orange-Red Light

An A-15 type, 14 watt blackout bulb, has been introduced by Sylvania Electric Products Inc., Salem, Mass., which is available at present only on priority rating better than A-2. This lamp is coated black except for a 1-in. aperture at the end which emits an orange-red light. It is available in voltage ranges of 115-125 volts and 30-34 volts.

Vard Thread Roll Snap Gage Does Close Checking of Work

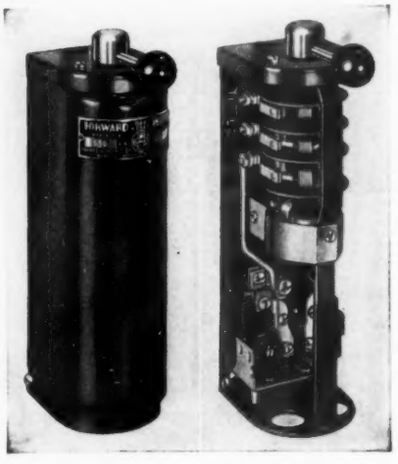
Improvement has been made in the visual thread roll snap gage produced by Vard Inc., Pasadena, Calif., for production inspection. This gage may be used flush against a working shoulder to check the pitch, thread form angle and lead of the work to be inspected. The precision rolls are ground from special tool steels, fitted with eccentric pins for adjustment to precision size to compensate for wear and allow



variable tolerances. This new model has a strengthened frame and convenient machine pads for bench setups. A full range of sizes in tolerances up to several thousandths, and in all pitches including metric, are available.

Furnas Drum Controller Has Thermal Overload Unit

The Furnas Electric Co., 438 McKee St., Batavia, Ill., has recently brought out a reversing drum controller with a built-in polyphase thermal overload unit of the solder-pot type and trip-



free. In case of an overload in any phase, signaled by a red indicator which projects through the top of the controller housing, the power is disconnected independently of the reversing part of the controller. The overload unit cannot be reset and power reconnected until the drum handle has been returned to the off position.

Infra-Red Duplex Expander Showers Heat Rays Uniformly

Infra-Red Engineers & Designers, 1633 East 40th St., Cleveland, Ohio, has introduced a duplex expander for such applications as expanding bearings and related housings for easy assembly, pis-

and now ---

THERE IS NO GEAR TOO SMALL TO BE FINISHED BY "SHAVING"

A one inch diameter annular gear being finished on a new Michigan 861-4B.

The new Michigan 861-4B which will accurately finish machine the minutest gear in far less time than it takes to read this advertisement.

For the past few months we have been busy telling you about the new "Michigans" on which you can shave gears up to 4 ft. in diameter.

Now we would like to introduce to you the new Michigan 861, designed for the producer of small gears—for instruments, for control mechanisms, etc.—from a maximum of four inch diameter down to as close to zero diameter as you can make a gear.

It will handle gears up to 1 inch face width and down to "nothing". The gears can be mounted on shafts up to 9 inches long or they can be annular types with no shafts at all.

Just rough them out, put them on the Michigan 861-4B crossed axis gear finisher and in a few seconds they will be finished to within tenths of a thousandth.

MICHIGAN TOOL

7171 E. McNICHOLS ROAD *Company* DETROIT, U.S.A.

7 TIMES AS FAST with DoAll BAND FILES

Filing sheet steel parts for instrument cabinets and panels now speeded through with DoAll Band Files. Formerly done on nibbler and hand filed.

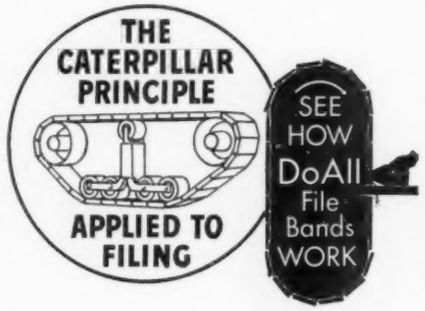
CONTINUOUS ONE-WAY STROKE

There's no stopping or back-stroking. Filing with a DoAll means steady, one-direction travel, with even pressure until the job is perfect. This caterpillar principle means you are cutting at maximum all the time.

Then—there are tremendous savings in file costs. For example, on a recent test, a DoAll Band was run at the rate of 100 feet per minute filing Ketos Steel held against the file by 25 pounds' pressure. The file band ran continuously for 125 hours before showing wear.

There's a wide range of styles, cuts and widths to take care of any kind of material.

Send for new File Booklet, prices and discounts.



THE DOALL COMPANY

1210 Thacker St. DesPlaines, Ill.

Associated with Continental Machines, Inc. Minneapolis, Minn.

tons, connecting rods to permit bearing "drop in," rocker arms, gears and many other diversified applications. The parts are simply laid on a plate glass shelf where they are showered with uniformly distributed heat rays. Both heater units are wired for 375 watt lamps and the power load with this lamp is 3 kw., with 250 watt lamp it is 2 kw.

The equipment includes V-type insulated-reflective heater units 11×28×9 in. deep, wired, one above and one below. Both V-housings are fully insulated with compressed Fiberglas 1 in. thick. Two hundred and fifty watt inside silvered, parabolic reflector lamps are furnished with the expander as well as a shatterproof heat-resisting, tempered, plate glass shelf size 11×28×¼ in. thick. Variable adjustments are provided for both the plate glass shelf and the heater units.

Klearsite Goggle Cover Glass Gives Long Welding Service

Klearsite, a cover glass for arc hoods and welding goggles, has been brought out by Carter-Lockard Co., 225 W. 11 St., Los Angeles, Calif., which will stay clear for over 100 hours welding time. Sparks and molten metal with which the glass comes in contact are repelled. "Dill berries" that stick to ordinary glass slide off this new Klearsite. The size of the cover glass is 2×4¼ inches.

NEW MATERIALS

Solventol Gives Clean Corrosive-Resistant Surface

For the cleaning of munitions components made of steel, brass, copper, aluminum, magnesium and zinc diecastings, Solventol Chemical Products Co., 15841 Second Ave., Detroit, Mich., is marketing Solventol No. 27. The No. 27 compound is made up of a synthetic organic base with solvents, but it has greater soil-dispersive powers. Furnished in the form of a liquid concentrate, the material is usable with 30-60 parts water, is neutral to production metals and provides work with a chemically clean surface that is passive to corrosion under average factory conditions for one to four months.

Solventol 27 employs the physiochemical phenomena of the new synthetic organic chemistry. Two actions are promoted. First, the solvents penetrate the soil, which may be made up of dirt, oil drawing compound, grinding dust, chips, to establish a layer of solvent at the "interface" between the metallic surface and the overlying particles. Second, the dispersive powers of Solventol completely separate oil or grease particles from the inert particles of dust, grit or chips. No saponifying or emulsifying action takes place and hence no soapy film is left on the

work. Flushing action of spray jets or slot-type orifices removes not only the oil particles but the inerts as well from the work piece. Even smuts of fine particle size are removed from the bores of precision parts. Drilled and tapped holes can be thoroughly cleansed.

The soil-laden solution is self-cleaning when it drains into the reservoir, from whence, it is recirculated. Inerts drop to the bottom of the tank: oil particles float on top, eventually overflowing into a sump. The solution is also self-maintaining for long periods. Approximately 60 percent of the concentrate goes into immediate solution with water, the balance floats on top of the aqueous solution and gradually dissolves.

These actions permit production parts to be cleaned in a single-stage washer followed by an air blow-off to remove water droplets. Heat stored in the work (the acqueous solution is used at 130-170 F.) completes the drying process before rusting can occur.

Parts so cleaned are bright, unspotted, and passive to corrosion by fingerprinting or atmospheric moisture for lengthy periods. Since the No. 27 concentrate is neutral, the workpieces are not pitted. Inspection time is cut and rejections reduced by the clean bright surfaces of the work. If the part is to be plated, the absence of spots avoids plating losses.

By salt spray tests, it has been shown that the surface condition produced with Solventol No. 27 gives a paint bond with a better than usual life. Passivity of the surface has permitted the elimination of painting the inside of shell before transfer to the loading plant. The same condition, it is said, frequently eliminates the need for applying rust-preventive compounds and waxes to precision parts held in storage and awaiting assembly.

In addition to its other properties, Solventol 27 is non-toxic. It is a stable material and does not cause dermatitis. Existing washing equipment can be used with minor modifications.

Mitts Non-Sticky Skin Cream Easily Removed With Water

A soft, snowy, fragrant cream that vanishes as soon as applied has been made available by Mitts Mfg. Co., 367 E. 45th St., Brooklyn, N. Y., to protect the hands, from grease, paint, dust and other matter. The skin cream is non-sticky and non-staining and washes off in soap and water. It is packed in jars.

Unichrome Alkaline Bath Strips Copper Coatings Fast

Development of Unichrome alkaline stripping bath has been announced by United Chromium, Inc., 51 East 42 St., New York, N. Y., for fast stripping copper coatings at speeds up to 0.001

Steel-Service Plants Vital to War Effort

Wartime manufacturers by the thousands are relying on their nearby Steel-Service warehouses to supply small quantities of urgently needed steels. Emergency repairs; bottle-necks in mill deliveries; threatened production line shortages; steel for experimental and model machinery —these problems are all a part of the day's work for a Steel-Service Plant. These firms, among whom Joseph T. Ryerson & Son, Inc., in particular, has shown exceptional ingenuity in solving wartime problems.

(*See Advertisement*)

Answering inquiries and handling customer problems at Ryerson.

True: Steel is Short-
But Ryerson Often Solves the Problem

IN America's vast production effort, there is some man in every company who is responsible for *getting* steel—a man who must get things *done.* In some plants he's called an "expeditor". But whether he is purchasing agent, expeditor, or plant manager, he *must get results.*

Ryerson Steel-Service is built to order for his needs! When steel problems become a stone wall, Ryerson usually can come thru with some practical solution. A suitable alternate for steel that's vitally needed, but isn't in stock; a suggestion for heat-treating, machining, welding, or some other way to adapt the steel at hand; rush handling and delivery that will lay the steel down where it's needed, *when* it's needed!

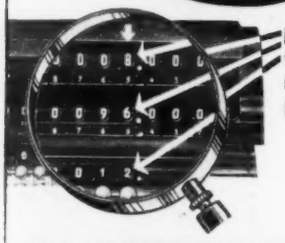
While this is all in the day's work for Ryerson Steel-Service men—you must keep in mind that we are entirely out of many kinds and sizes and that all must be sold in strict accordance with the WPB program.

This help in getting things done is available to your organization. Ryerson Steel-Service men are easy to reach; they'll give you prompt consideration.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Detroit, Cincinnati, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

RYERSON STEEL-SERVICE

for calculating
Hobbing Leads and Feeds
and other uses!



All 3 factors stand in plain sight

MARCHANT

the electric calculator with straight-line figure dials for ALL 3 FACTORS!

Save the time of high-wage personnel now figuring with pencil and paper, or with eye-straining approximating devices having uncertain decimal points. A MARCHANT gives "the answer" quicker . . . correctly pointed off . . . and with *all 3* factors in plain sight for checking.

This is why MARCHANT is so popular in shop and drafting room . . . and explains why more and more firms are putting one within easy reach of each desk.

Try an Automatic Electric MARCHANT at our expense.

32nd year

TEAR OFF COUPON AND MAIL TODAY!

MARCHANT CALCULATING MACHINE COMPANY
HOME OFFICE: OAKLAND, CALIFORNIA, U. S. A.
Sales Agencies and Manufacturer's Service Stations Give Service Everywhere!

☐ *Send* Marchant Feature Analysis Folder.
☐ *Send* "7 Place Natural Trig. Functions with Increments to Seconds" with Sine-Arc and Sine-Cosine tables. (*25 cents in stamps enclosed.*)
☐ *Send* "Simplified Sq. Root and Cube Root Method."
☐ *Send pamphlet* "Adding Fractions for Checking Drawings." AM/10/15/42

Firm _____
Individual _____
Address _____
Use margin of page if necessary

in. in 10 minutes or less without any effect on the steel base metal.

The bath is a mildly alkaline, nontoxic solution which does not etch the steel base metal. This property is valuable where maintenance of the finish and avoidance of pitting are essential.

TRADE PUBLICATIONS

ABRASIVES A folder citing the advantages of uniformity of hardness and grain structure in honing and superfinishing stones was published recently by the Mid-West Abrasive Company, 1960 E. Milwaukee Ave., Detroit, Mich.

ALLOY "How Aircraft Designing Engineers use Ampco Metal," is described in a brochure offered by Ampco Metal, Inc., Milwaukee, Wis.

BALANCING Data on dynamic balancing and its importance in eliminating noise and premature wear due to excessive vibrations resulting from couple action, are given in a booklet offered by Bear Mfg. Co., Industrial Div., Rock Island, Ill.

BEARING METALS A bulletin of the Magnolia Metal Co., 18 W. Jersey St., Elizabeth, N. J., describes various lead-base metals which have been found exceptionally long-wearing on shock loads, or heavy sustained pressures, and on general service and have proved to be excellent substitutes for tin-base bearing metals. The bulletin includes a number of practical suggestions for best results in making and maintaining journal bearings, and a table of recommendations for selecting the correct type of bearing metal for 135 different types of machinery.

CLEANING A newly revised and enlarged fourth edition of a 24-page manual on cleaning and de-scaling water-cooled or water-circulating equipment, has been issued by Oakite Products, Inc., New York, N. Y.

CONVEYING CHAIN The American Manganese Steel Div. of the American Brake Shoe and Foundry Co., 389 E. 14 St., Chicago Heights, Ill., has published bulletin No. 742-CN, "Chain for Elevating and Conveying".

CONVEYOR PULLEYS Solid- and split-type conveyor pulleys, in various face widths, diameters and bores are described, and prices quoted in bulletin No. CP-42 of the American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.

CUTTER Campbell Model No. 425 Cutalator abrasive cutting machine is described in a new booklet recently issued by Andrew C. Campbell Div. of American Chain and Cable Co., Bridgeport, Conn.

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CUTTING TOOLS A condensed catalog of the Genesee Tool Co., Fenton, Mich., illustrates and lists sizes of standard tools available and shows a number of group photographs of special tools the company is equipped to produce.

CUTTING TOOLS Correct practices in reconditioning taps are detailed in a wall chart available from the Detroit Tap and Tool Co., 8432 Butler St., Detroit, Mich.

DERMATITIS "Prevention of Dermatitis" is the title of a folder issued by Standard Safety Equipment Co., 232 W. Ontario Street, Chicago, Ill.

ELECTRIC EQUIPMENT A 42-page booklet (GEA-3395), illustrating and describing the precision-built equipment offered for the aircraft industry, has been issued by the General Electric Co., Schenectady, N. Y.

DRILL PRESS A high speed drill press developing speeds up to 23,000 r.p.m. is described in a folder offered by Edward Blake Co., 634 Commonwealth Ave., Newton Centre, Mass.

DRILL PRESSES A radial drill press capable of drilling, tapping, routing and light profiling is described in a publication of the Walker-Turner Co., Plainfield, N. J. Another publication of the same company describes and illustrates 20-in. drill presses of the "1100" series.

FASTENERS Airloc cowling fasteners for plywood are described in a folder prepared by the United-Car Fastener Corp., 31 Ames St., Cambridge, Mass.

FILTERS Filters, Inc., Glendale, Calif. has produced a new descriptive folder, "Dirt, Drip, Scale are Axis Agents, too", which shows how dirt, moisture and rust scale kept out of compressed air lines saves pneumatic tools and production-rejects. It suggests uses of air filters in aircraft, foundry, shipbuilding, machine shop and spray painting, and includes a diagram of a typical aircraft assembly installation.

FURNACES Two folders—No. SC-102 "SC Standard Rated Industrial Furnaces", and SC-103, "Wherever Heat is Used in the Production of Ships, Tanks and Planes"—have been prepared by Surface Combustion, Toledo, Ohio.

GAGING "Gaging Policy", a supplement to their previously issued "Dimensional Control", is offered by The Shefield Corporation, Dayton, Ohio.

GASKETS Armstrong Cork Company, Lancaster, Pa., has published a booklet dealing with specialized gasket packings and seals.

GRINDING "How to use Diamond Wheels for Internal Grinding of Cart-

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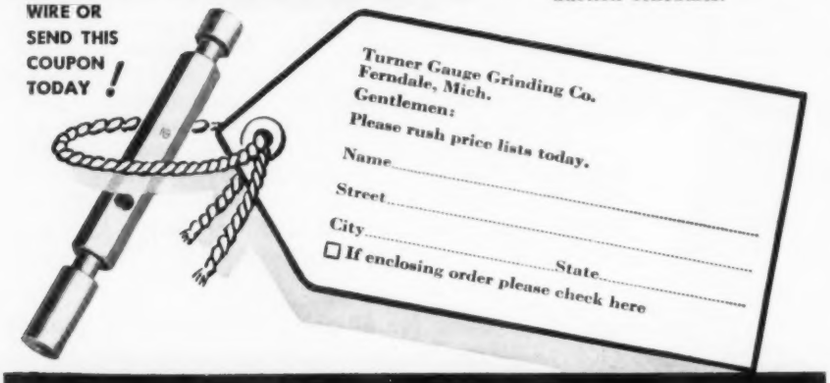

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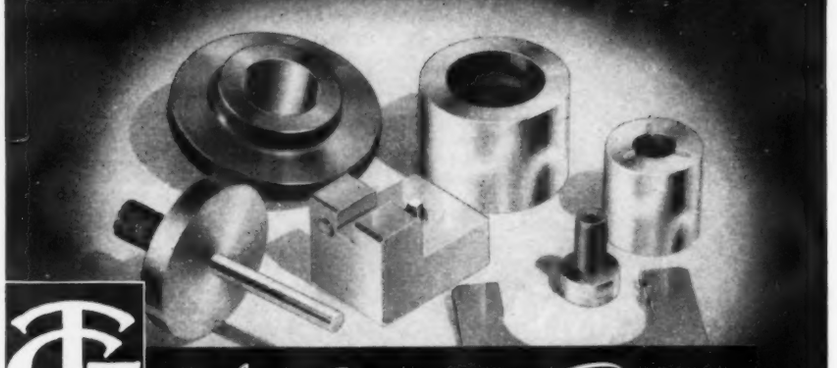

The Stamp of Precision

ridge Dies" is the title of an illustrated folder published by J. K. Smit & Sons, Inc., New York, N. Y.

GRINDING Instructions for using the knock-out chip breaker grinder with tilting table, for upkeep of carbide tipped tools, is described in a folder published by K. O. Lee Co., Aberdeen, S. D.

HEAT TRANSFER Information and formulae for determining overall heat transfer rates, the various factors influencing heat transfer through metallic walls, and the thermal conductivities of metals and alloys commonly used in the construction of process equipment, appear in a 20-page publication offered by the International Nickel Co., 67 Wall St., New York, N. Y.

HYDRAULIC OIL Requirements for good hydraulic oil are outlined, and Houghton hydro-drive described in a recently completed publication. A copy may be obtained by addressing E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia. Pa.

INSPECTION The George Scherr Company, 128 Lafayette St., New York, N. Y., has prepared a booklet, "Your Own Inspection Laboratory," covering briefly the use of gage blocks, comparators, projectors and other inspection department essentials.

LATHES "Keep Your Lathe Clean" is the subject of a bulletin issued by the South Bend Lathe Works, Dept. E9, South Bend, Indiana. The bulletin explains how keeping lathes clean will help increase production, reduce scrap and lengthen the life of the lathe. They have also issued a new catalog describing measures and "good housekeeping" routines in metal working plants.

MACHINE TOOL ACCESSORIES The Ideal Commutator Dresser Co., 1278 Park Ave., Sycamore, Ill., is offering a brochure describing and illustrating live centers, metal etchers, demagnetizers, grinding wheel dressers, balancing ways, variable speed pulleys, electric markers and portable cleaners.

MACHINE TOOLS A booklet recently published by the Delta Mfg. Co., 600 E. Vienna Ave., Milwaukee, Wis., describes and photographically presents the various manners in which their machine tools have been adapted to the armament program.

MATERIAL HANDLING Condensed catalog No. 130 of the Lyon-Raymond Corp., 1005 Madison St., Greene, N. Y., describes various designs of material handling trucks and lifts.

PANEL INSTRUMENTS A 12-page catalog, No. 4120, describing, listing and pricing 3 in. and 4 in. panel instruments, shunts and RT current

transformers for ratios up to 500/5, has been issued by the Roller-Smith Company, Bethlehem, Pa. Dimensions and mounting details on all standard panel instruments are shown and a map indicates the location of the company representatives, their entire line of engine, toolroom and turret lathes. Each size and type of lathe is illustrated and fully described, and accompanied by tabulated specifications.

PLANERS Liberty Planers, Inc., Hamilton, Ohio, has issued catalog No. 152 on heavy duty, fully automatic planers, No. 153 on standard duty, semi-automatic planers, an instruction manual on heavy duty planers and an instruction manual on standard duty planers.

PLASTICS "Bakelite Laminating Plastics" is the title of a new 24-page booklet published by Bakelite Corporation, 30 E. 42 St., New York, N. Y. It tells what laminated plastics are and describes their various types, including molded-laminated stock, engraving sheet stock, fluorescent and phosphorescent sheet stock, and densified-laminated wood.

POWER TOOLS Boice-Crane Co., Toledo, Ohio, has issued a general 48-page catalog (No. 42) describing and illustrating drill presses, jig saws, jointers, lathes, motors, sanders, saw tables and shapers.

POWER TRANSMISSION L. H. Gilmer Company, Tacony, Philadelphia, Pa., has launched a plan to conserve power, through discovering transmission leaks and bringing them clearly to executive attention. A book has been prepared to present this plan to industrial executives.

PRIORITIES "Priorities and Industry" is the title of an 83-page publication of the Division of Information, War Production Board, Washington, D. C. The publication describes "The Overall Pattern," "Control of Materials by Priorities," "How Priority Assistance is Granted," "What You Should do to Obtain Priorities Assistance" and has an appendix listing the priorities field offices and dealing with the delegations of authority, text and summaries of priorities regulations and directive for war-time construction.

RUBBER CONSERVATION Methods of conserving rubber products are described and illustrated in a 40-page book published and offered by the Goodyear Tire & Rubber Company, Akron, Ohio.

STEAM GENERATORS A new catalog of steam generators and necessities has been issued by the Vapor Car Heating Company, Inc., 80 East Jackson Blvd., Chicago, Ill.

SHEET METAL A folder describing their modern sheet metal specialties manufacturing facilities has been issued by Walters Mfg. Co., Oakmont,

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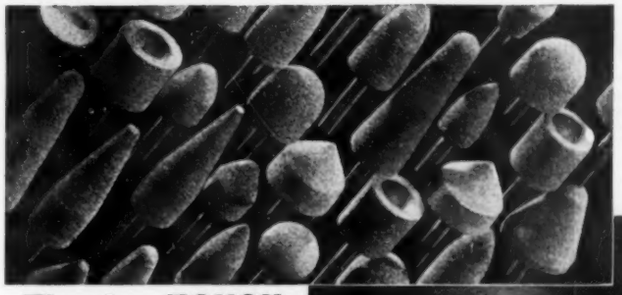

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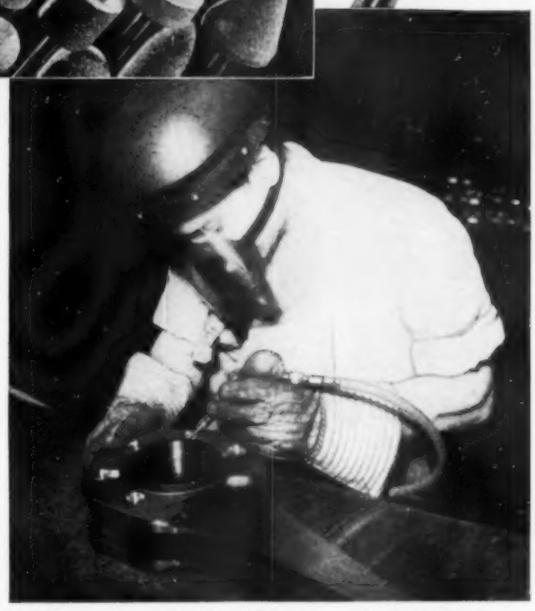

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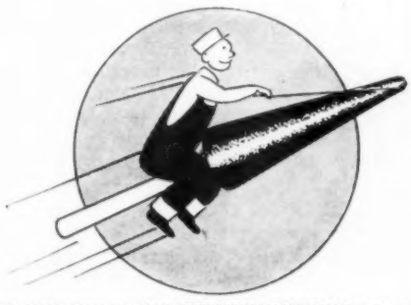

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Pa. Described and illustrated are the various departments, arranged for straight line production in shearing, braking, stamping, torch and spot welding, riveting, spraying and braking in 28 to 16-gage and up to 26 in.

WELDING A chart published by The Lincoln Electric Co., Cleveland, Ohio, will provide those concerned with weld production with a simple and extremely helpful aid for use in inspecting welds.

NEW BOOKS

DIESEL VEHICLES—*Edited by F. J. Camm, editor of "Practical Engineering," "Practical Mechanics," and "Practical Wireless." 110 pages. Published by The Chemical Publishing Company, Inc., 234 King St., Brooklyn, N. Y.* $2.

This book deals with practical aspects of design, methods of diagnosing injection troubles, and other factors in the operation, maintenance and repair of diesel vehicles. Some of the parts covered are the fuel-supply system, centrifugal and pneumatic governors, the pistons, rings and cylinders, and the connecting rod and main bearings. There is also a biographical chapter dealing with the diesel engine.

The book describes English practice and is illustrated with numerous pictures and line drawings. Reproduction is by the offset process.

•

BREAKING THE SKILLED LABOR BOTTLENECK—*By Eugene G. Benje, management engineer. 47 pages. Published by the National Foremen's Institute, Inc., Deep River, Conn.* $2.

This discussion of how to subdivide labor skills to gain maximum production is a result of a study undertaken in the summer of 1940 because of the impending labor shortage. This problem has become of utmost importance because of the full-scale mobilization of industry for war production. Our national safety now depends upon the ability of industry to utilize labor resources to the greatest extent possible. This study has shown that a subdivision of skill, coupled with intensive training, is the most promising method for immediate results. Nowadays, advertising for skilled help does little good, and other methods are showing negligible results. By careful training, upgrading of employees as they progress, and by careful supervision of all new employees, much good can be accomplished in increasing production at a time when this is most important.

In this book the author examines the various elements of skill, such as (1) what it is; (2) how it can be developed more rapidly than by former methods; and particularly (3) how some skills can be subdivided into

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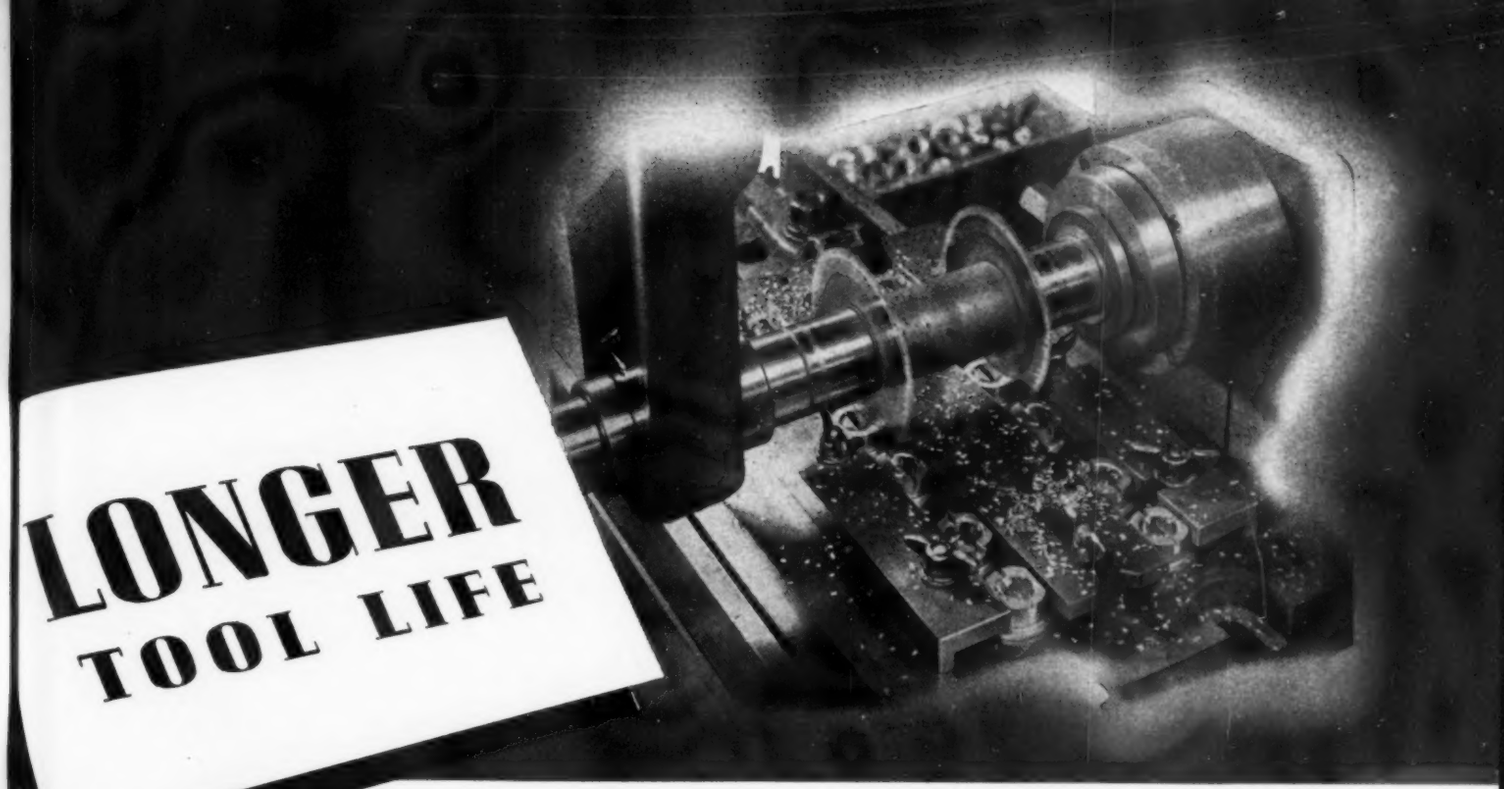

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Now, when maximum production from each tool is so vital, this particular feature of Vickers Hydromotive Control looms larger than ever before. Vickers Application Engineers are always available to discuss individual problems of improving machine performance by improving machine controls.

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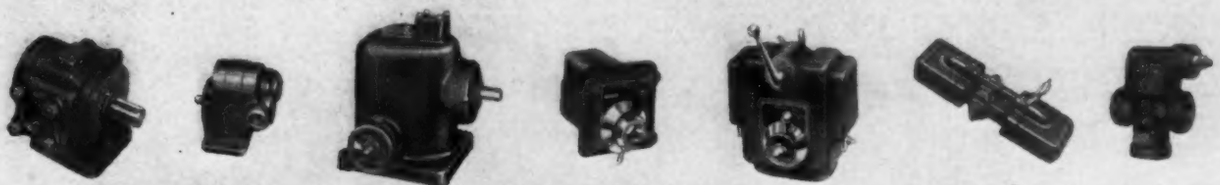

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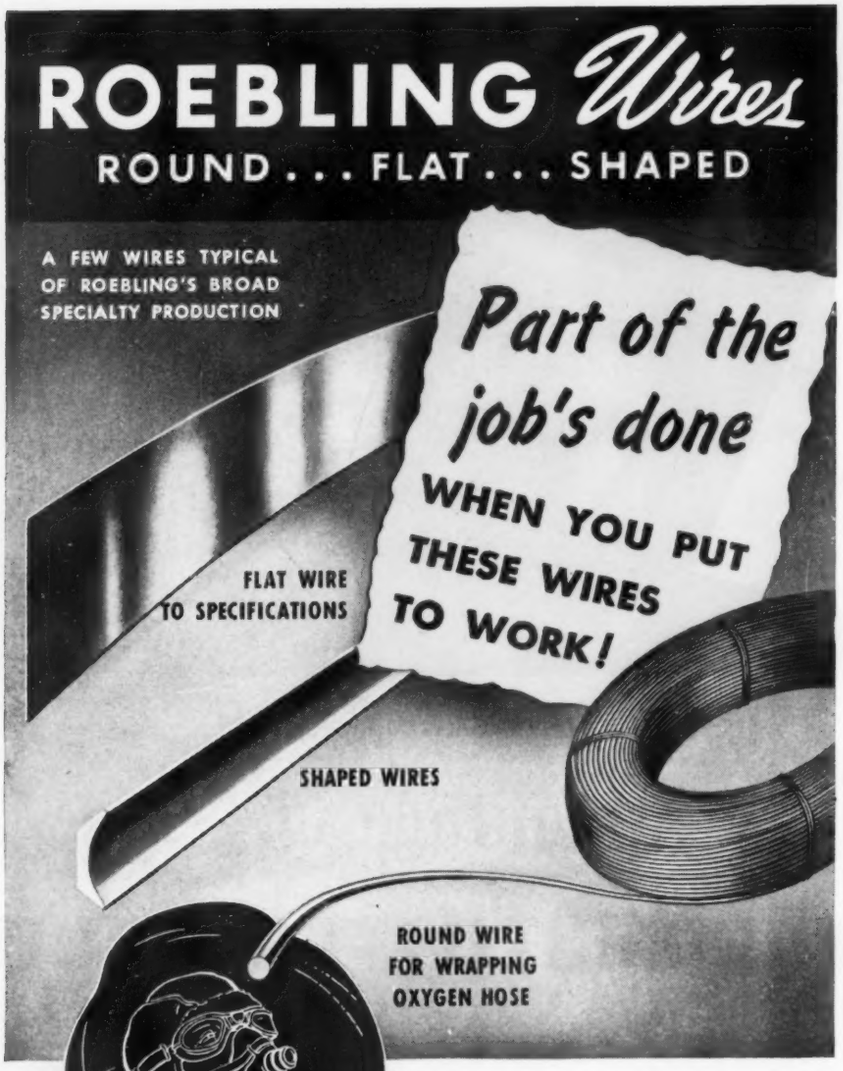
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Part of the job's done
WHEN YOU PUT THESE WIRES TO WORK!
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parts or sections, perhaps of varying degrees of difficulty, which might be taught separately to different individuals. The author covers these questions in detail, beginning with the necessary fundamentals which must first be understood by all involved, and then following through with practical answers derived from experience.

•

BLUEPRINT READING FOR THE METAL TRADES—*By W. A. De Vette and D. E. Kellogg, vocational department of the Erie Public Schools, Erie, Pennsylvania* 132 *pages. Published by the Bruce Publishing Company,* 540 *N. Milwaukee St., Milwaukee, Wis.* $2.50.

The commonly accepted method for transmitting manufacturing information in the machine shop is by drawings or blueprints, and it is important that every member of a manufacturing organization in the metal-working field be familiar with this method. It is virtually impossible to convey production information by word of mouth, even in the smallest shops.

In this volume the authors have presented a carefully worked out method of learning to read blueprints and to make freehand sketches, by which a mechanic can convey information and sometimes clarify a drawing for himself. The material is arranged in order of difficulty, so that the student proceeds in easy stages from simple sketches on through increasingly difficult problems. The text is well illustrated, and it is necessary for the student to understand the data conveyed by each drawing in order to answer the questions given with each assignment.

The text first discusses the blueprinting process and then describes the orthographic method of projection and the proper method of dimensioning drawings. Next, the student is told how to read a drawing and is given a number of sketching problems. Following this, in order, the text covers invisible edges, oblique surfaces, cylindrical objects, sectional views, screw threads, the reading of dimensions, assembly drawings, finish and finish marks, limits, tolerances and allowances, gearing, and miscellaneous blueprint reading problems.

•

A PHOTOELASTIC STUDY OF STRESSES IN GEAR TOOTH FILLETS—*By Thomas J. Dolan and Edward L. Broghamer. Engineering Experiment Station, Bulletin Series No.* 335. 44 *pages. Published by the University of Illinois, Urbana, Ill.* 45 *cents.*

This bulletin is limited to a presentation of the results of a study of some of the factors influencing the localized stresses occurring at the fillets of several types of gear tooth, as obtained from a series of tests of photoelastic models of spur gear teeth. This investigation was undertaken with the

plan of covering a wider range of variables than those covered by other investigators, in order to obtain a clearer understanding of the relative effect of some of the variables influencing the localized stresses at gear tooth fillets. No attempt has been made to determine the extent to which the theoretical stresses are of significance in causing damage to actual metal gears in which the relative "notch sensitivity" and localized plastic readjustments in the material may influence the damaging value of stress.

Tests of eleven models were made in which the shapes of the teeth were changed by altering several variables (pressure angle, number of teeth, fillet radius, length of addendum, and dedendum) and a concentrated load was applied at varying positions on the tooth face. Complete information on the results of the tests is given, and a method of locating the weakest section of a gear tooth and of determining fillet radius is given in an appendix included in the bulletin.

•

INDUSTRIAL DRAWING—*By H. R. Thayer, assistant professor of engineering drawing, The Pennsylvania State College.* 195 *pages. Ring binding. Published by McGraw-Hill Book Company, Inc.,* 330 *W.* 42 *St., New York, N. Y.* $1.75.

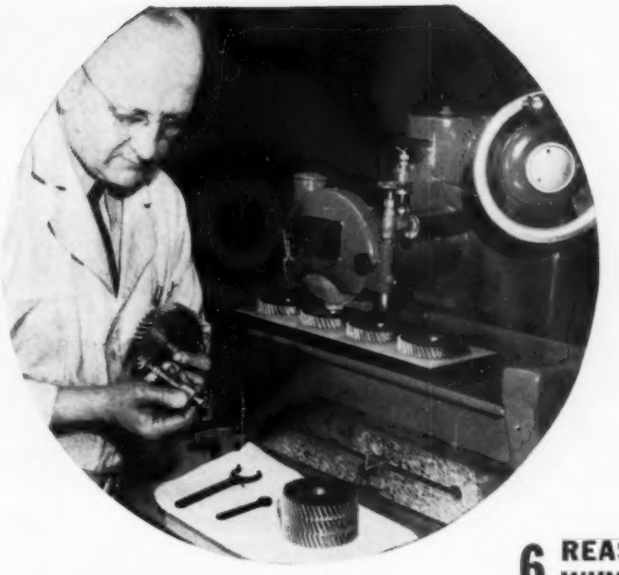
This volume has been written primarily for those who wish to study mechanical drawing and should be an extremely handy medium for teaching industrial drawing, especially to adult students. It has been compiled in the form of lessons and arranged to be used by regular classes, but will also be found suitable for those who wish to study alone.

Directions are given for drawing lines, the use of the engineer's and architect's scales, protractor and for lettering. Among the subjects covered are dimensioning and symmetry of drawings as well as method of making isometric, oblique and perspective drawings, with each lesson illustrated in detail. Questions and problems are provided in every lesson.

•

AIRCRAFT ENGINE TROUBLE SHOOTING CHART—*Arranged by Andrew Wallace, crew chief, Eastern Air Lines, Inc. Published by the Norman W. Henley Publishing Company,* 17-19 *W.* 45 *St., New York, N. Y.* 75 *cents.*

This 22×32-in. aircraft engine trouble shooting chart for all types of engines is arranged so that one can easily trace and learn the proper way to correct engine troubles. Troubles are diagnosed through the medium of a "sound section" on the chart, which in turn identifies the troubles in smaller sections arranged around the sound section; then, all the sections are connected with guide lines to enable one to quickly employ the proper procedure for their correction.



Four hardened gears are ground at the same time, insuring identical thickness and great savings of time.

DoAll MIRACLE GRINDER

This ultra-modern precision grinder is preferred in hundreds of busy plants today because of its super accuracy. The mirror-like finish obtained on the DoAll is so smooth and exact that you can actually "wring" two flat surfaces together.

Work is visible at all times, being perfectly lighted by a cool, fluorescent bulb located under the wheel cover.

Adaptable to either wet or dry grinding, the DoAll Grinder comes in two sizes, with 7" or 10" wheel.

Write for interesting literature about this better grinder.

6 REASONS WHY THIS GRINDER IS THE BEST

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Speed is the essence of production for Victory and speed is "Yankee" Tools' middle name . . . speed and precision and a tremendous capacity for getting things done and done right.

Behind these pre-tested fine mechanics' tools is a half century of know-how. It has made "Yankee" Tools the preferred tools in all fields. It accounts for the fact that even our all-out effort does not fill every demand during wartime.

Be sure to provide priority ratings whenever possible. Order from your supply house or write North Bros. Mfg. Co., Dept. AM-10, Phila., Pa. Every effort will be made to meet your requirements.

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make good mechanics *better*

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Established 1880

SEEN and HEARD

By JOHN R. GODFREY

Rubber in Press Work

The use of rubber blankets and strips in forming sheet metal for airplane parts is a big development from small beginnings. The first use of rubber in this way was probably in what was known as the "bulging die" used to enlarge, or "swell," the outer end of saltcellar tops. Rubber followed the use of water for this purpose and dates back "nigh on to 50 years."

Using water, or oil, as was done in forming the tone arms of the old Victor phonographs, necessitated the use of high pressure packing to keep the oil or water from leaking all over the place. But in spite of this it was used successfully for a number of years in a number of plants.

We are finding that rubber is not compressible to any extent. It changes shape readily and comes back. But when confined in a frame that prevents side movement, it is much more solid than we used to think. That is why it exerts enough pressure to force metal around sharp corners.

Can Run Them Too

Many of the women who are now at work in machine plants of various kinds are developing a skill that is gratifying and perhaps a little surprising to some who felt that machine work was out of their line. Women are now running thread grinders and gear-cutting machines in some of the aircraft plants and doing a good job at it.

To be sure the machines are set up by expert mechanics, which is also true when they are run by the average man. But it's a safe bet that some of these women will be setting up their own machines before many months.

With either men or women it depends on their mechanical sense and how good they are at making calculations. The ability to make calculations is not confined to either sex, as witnessed by the many women teachers of mathematics.

How to Use Hardness Tests—Correction

In the article "How to Use Hardness Tests" (*AM*—Vol. 86, pages 1075-78) by C. H. Gray, Westinghouse Research Laboratories, the pair of charts appearing at the bottom of page 1075 was inadvertently transposed with those appearing at the top of page 1076. To read the article correctly apply the caption for Figs. 1 and 2 to Figs. 3 and 4 respectively and vice versa.

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. . . longer fluorescent lamp life
. . . greater lighting efficiency
. . . full use of your wiring system
. . . DEPENDABLE SERVICE

E. T. L. is not a brand but a mark of certification by one of the world's foremost electrical testing laboratories.

Specify fluorescent fixtures using E·T·L CERTIFIED STARTERS and BALLASTS

When you're planning fluorescent lighting for war work, or making occasional necessary replacements in older installations, it's important to make sure that fixtures use Ballasts and Starters tested and *Certified* by Electrical Testing Laboratories, New York—to assure dependable, trouble-free operation. These "control units" have more to do with the satisfactory performance of fluorescent lamps than any other part of the fixture.

E. T. L. Certified Ballasts and Starters are a specified part of every Certified FLEUR-O-LIER fluorescent lighting fixture. All FLEUR-O-LIERS, control equipment included, are built to 50 definite specifications set up by MAZDA Lamp makers for the protection of the user, and for maximum light from the lamps, and are tested and Certified by E. T. L.

FLEUR-O-LIERS are made in various sizes and designs by over 45 leading fixture manufacturers located at important points all over the country. This means better service on war plant orders, which, of course, are now filled on necessary WPB priority rating.

This label identifies a genuine FLEUR-O-LIER. When you specify fixtures, be sure to look for it!

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

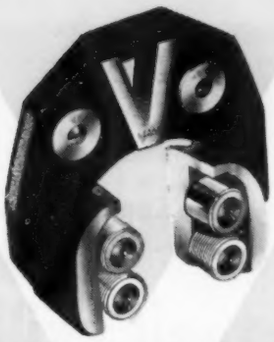
Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

FORCED MARCH...

Night and day, the workheads of industry are spinning on war production. For the vital tools at these workheads, you cannot set your quality standards too high.

MORSE THERE *IS* A DIFFERENCE **TWIST DRILL AND MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.



VARD Roll Thread Snap Gage—A quality Production Inspection Tool built in sizes from No. 0 to 12-in. diameters.

VARD Cylindrical Plug Gages—With or Without Special Patented Pilot.

Made in a complete range of sizes from ⅛-in. to 6-in. diameters. X, Y, and Z tolerances.

VARD Threaded Plug Gages—Made in all National and Metric thread forms and many special pitches.

Vard Gages are Accurate, Easy to use and have long Life

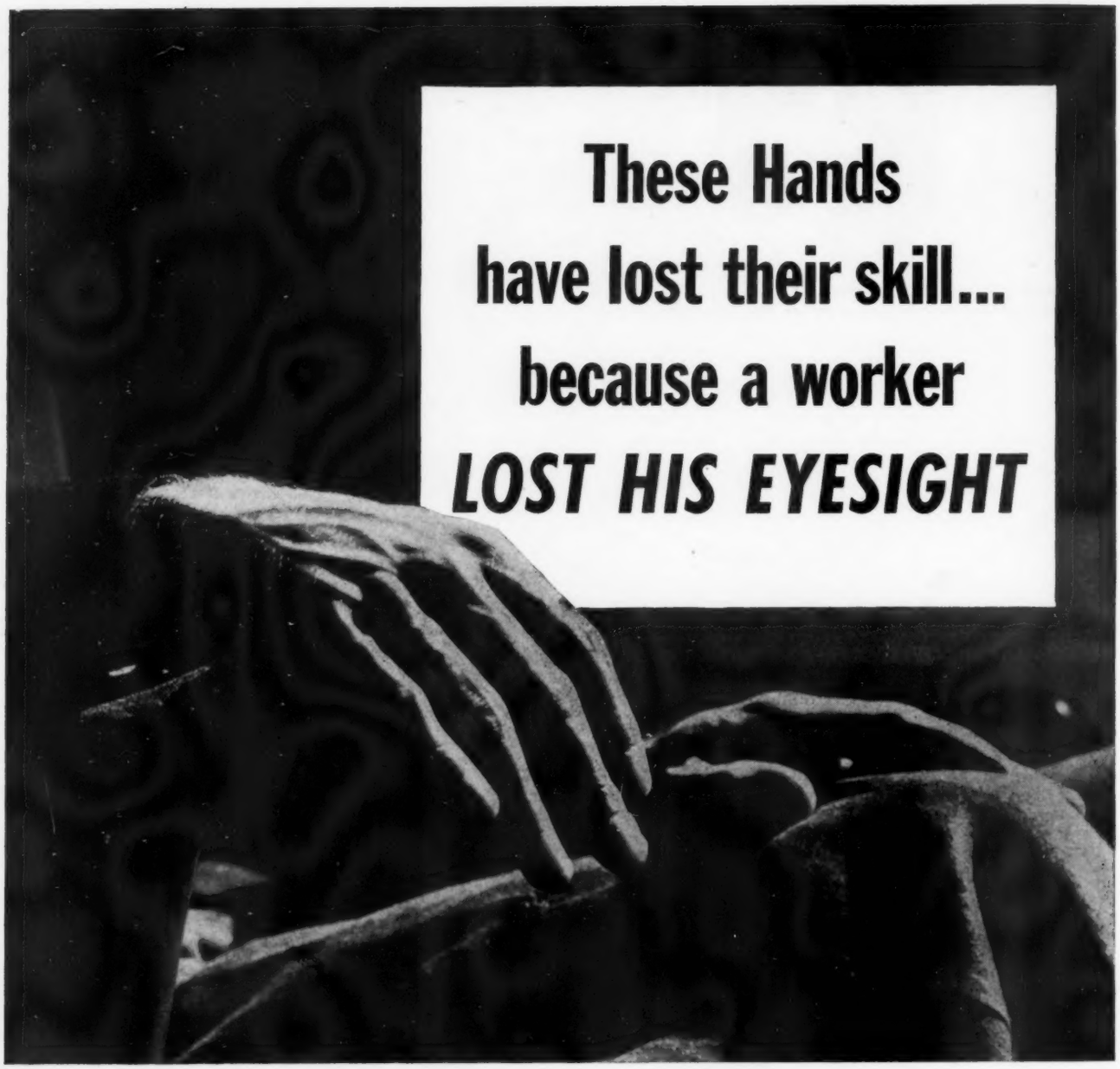
VARD Threaded Plug Gages—Made in sizes from No. 0 to 6-in. diameters.

These three qualities are found in all VARD gages. Accuracy is the end product of fine production machinery, skilled craftsmen and careful manufacturing control. Ease of Use comes through correct design—and we have a proving ground in our own large shops turning out precision aircraft ordnance and naval parts. Each type of VARD gage gets months of "use test" before it goes on the market. Long Life is the result of correct design and high quality steel. Here too VARD compensating adjustments on some types of gages prolongs service life.

Most VARD gages when worn through use may be returned to our factory for reconditioning. Such VARD reconditioned gages are as accurate as new gages.

VARD INC.

PASADENA, CALIFORNIA



protect your workers' eyes with AO Goggles

Without eyes to guide them, skilled hands can't produce. Protect your workers' eyes *now* — before it is too late... for the war of production cannot spare the services of a single man or woman. To win this war, *all* skilled hands must be producing on full-time schedule.

American Optical Company offers you a complete line of scientifically designed goggles... a specialized type for every kind of eye hazard in your plant. For effective protection against impact, we recommend goggles equipped with Super Armorplate lenses... without power or ground to individual prescription. Call in your American Optical Safety Representative today.

American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS

BULLETIN BOARD

WPB PRODUCTION DRIVE

STEP UP PLANT EFFICIENCY BY—

1 TAKING CARE OF TOOLS
2 PREVENTING BREAKDOWNS
3 CUTTING DOWN ACCIDENTS
4 GOOD LIGHTING
5 MAINTENANCE AND REPAIR
6 ADAPTING OLD MACHINES TO NEW USES
7 CUTTING WASTAGE
8 BREAKING PRODUCTION BOTTLENECKS
9 USING EVERY MACHINE TO THE FULLEST EXTENT

Five of the nine suggestions for "Increasing Plant Efficiency" in WPB's PRODUCTION DRIVE include problems in which Standard Lubrication Engineers can give you valuable help. For instance:

7 CUTTING WASTAGE

• CUTTING WASTAGE of oil is important. But cutting wastage caused by poor lubrication is one of today's most serious problems.

There's where a Standard Oil Engineer can be of real help to you. He can locate hidden waste that you might overlook in the press of other problems. Here are some of them:

- Excessive power consumption on conveyors, reduction gears, etc., caused by wrong lubricants.
- High labor costs for cleaning gear cases, oil circulating and hydraulic systems.
- Lost production time from unnecessary shutdowns for cleaning.
- Damaged equipment caused by the use of the wrong lubricant through inefficient lubricant handling methods.

There are many more ways that wastage can slow down your drive for production. Let a Standard Lubrication Engineer help you find them. Take advantage of his recent experience on problems just like yours.

HOW TO PREVENT WASTE IN HANDLING LUBRICANTS

The Engineering Bulletin, "Storage and Handling of Lubricants," may have a few timely suggestions for you to help prevent wastage caused by contamination of lubricants in your plant. It will be particularly helpful to new men in charge of lubrication. A copy will be sent you without obligation. Just write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago, Illinois.

OIL IS AMMUNITION...USE IT WISELY

STANDARD OIL COMPANY (INDIANA)

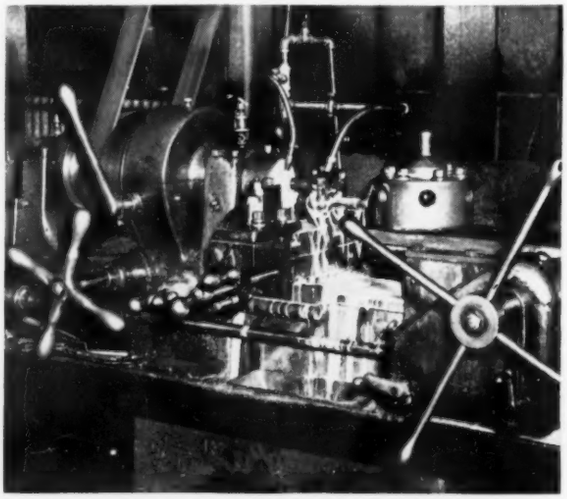
RICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENG

NG • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICA

WHEN RETOOLING FOR WAR PRODUCTION, GET CUTTING OILS ENGINEERED FOR THE JOB

• NEW OPERATIONS—new operators—new metals. There's no end to the new problems in plant conversion or retooling for war production. None is more important than getting the right cutting oil on these new operations—to get the speed, finish, and accuracy to meet production demands. But even this problem is easily solved, if you get a Standard Oil Engineer's help.

These Engineers have worked with many plants on retooling—they've helped develop new cutting oils and coolants where needed—made new applications of old products. They have gained, from

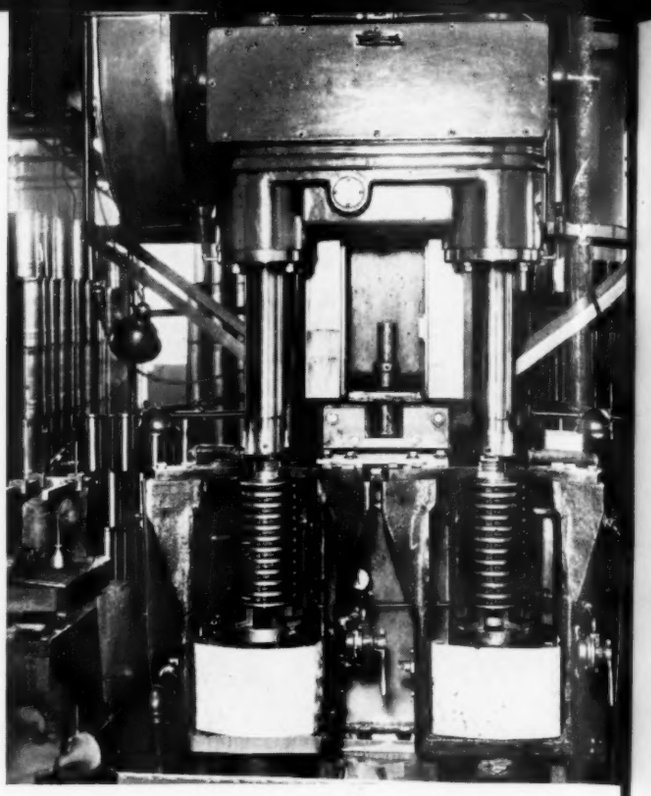


Using coolants and cutting oils engineered for the job will help increase production, improve the finish and lengthen tool life.

their own experience, and from the exchange of information with other Standard Oil Engineers, a wide knowledge of war production jobs.

In addition, they have the research and technical facilities of the Standard Oil Company on which they can call if your problem is different.

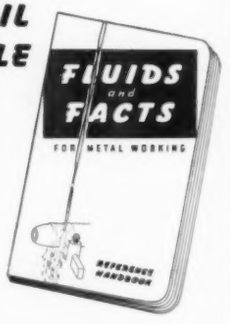
Take this short cut to faster production—call in a Standard Oil cutting oil specialist.



10 YEARS WITHOUT MACHINE TOOL BEARING FAILURES WITH SUPERLA GREASE

Even with production of pistons stepped up to today's war pace, a Michigan manufacturer finds the ten-year-old recommendation of a Standard Oil Engineer—Superla Grease for sleeve and ball or roller bearings—keeps bearing failures to the minimum. Superla is used on grease-lubricated bearings of equipment such as the vertical broach pictured above. Let a Standard Lubrication Engineer make a lubrication survey of your machine tools. He may save you hours of shutdown time for bearing maintenance and replacements.

ASK YOUR STANDARD OIL MAN FOR THIS VALUABLE HANDBOOK



"Fluids and Facts for Metal Working" is a handy, pocket-size manual packed with 50 pages of facts and tables useful to shopmen—conversion tables—machinability ratings—spindle speeds vs. surface speeds—cutting oil recommendations, etc. Take time to see a Standard Oil representative next time he calls. He'll have a copy for you.

HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Call any local Standard Oil Company (Indiana) office in the middle western states listed below, or write 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIAN

TAFT-PEIRCE GAGES were used in controlling dimensions of military materiel for years before this war began . . . and in industry for years before that. Today the Taft-Peirce Gage Division is a sizable industry in itself, producing one of the world's most complete lines of standard and special gages . . . thousands of which are preserving precision and saving time in arms, munitions, and aircraft production . . . consistently and accurately measuring the maximum amount of work per gage.

THE *Taft-Peirce* MANUFACTURING CO.

WOONSOCKET *RHODE ISLAND*

PROTECT the Employee and SPEED Production—

For 27 years Bethlehem has been waging war on the most dangerous saboteur of industrial production—accidents. Today, with the future of the nation so dependent upon top-speed production of war steel, we are stepping up the safety and first-aid effort on a widening scale.

First-aid instruction is being given to thousands of employees. Established safety practices are daily being intensified. More safety shoes, goggles, helmets, respirators and fire-proof clothing. More warning signs and flags to mark danger spots. More safety posters to keep workers safety-conscious. . . . No detail is overlooked which can possibly contribute to the fast, efficient, *safe* production of steel for America's ever-growing war needs.

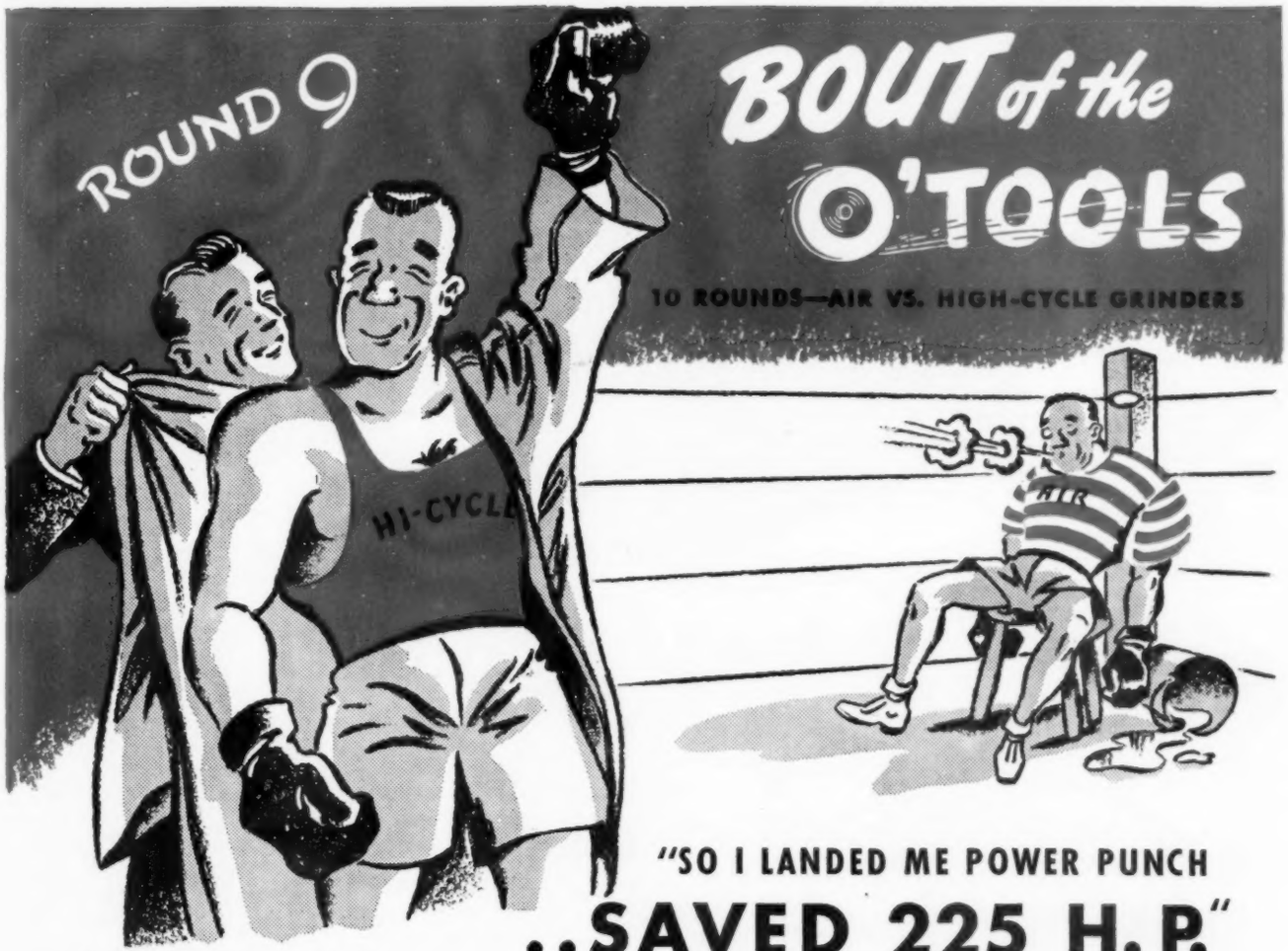
TOE-SAVING SHOES—Each of these five steel-reinforced safety shoes saved a foot from painful injury and kept one more worker on the job, fit, and able to continue doing his share to keep up the flow of Bethlehem's war production.

DANGER SPOT—But it's been rendered harmless by a short railing and a sign. Instead of stepping out blindly from the corner of the building, workers must cross the track at a point where they can hardly fail to notice an approaching train.

REHEARSAL—This team of first-aid men is giving treatment to an accident "victim" at one of Bethlehem's first-aid contests, held annually for many years. Thanks to this training, thousands of Bethlehem-trained first-aiders are constantly on the alert in steel plants and mines to prevent or treat industrial accidents.

SAFETY SCHOOL—By movies and lectures, Bethlehem employees are continuously being trained in the safest, most efficient methods of handling their jobs. Year after year, this education in the safe way to do every job goes steadily forward.

BETHLEHEM STEEL



"SO I LANDED ME POWER PUNCH ..SAVED 225 H.P."

• This new steel mill called in the Rotor Analyst for an unbiased recommendation for grinders. Should it be AIR or HIGH-CYCLE? Each has its place—depends on the individual plant situation.

So they sounded the gong for Round 9, Bout of the O'Tools. Both AIR and HIGH-CYCLE were evenly matched on production punch. But HIGH-CYCLE won on power punch: Lower first cost—saved over $7,100 in cost of power units. Lower power cost—saved 225 B.H.P. which, on full load operation at 1¢ per K.W.H., saves over $3,000 per shift yearly—a substantial contribution to the war effort.

Why not be sure you get peak production from portable tools at rock-bottom cost? Call in the experienced, unbiased Rotor Analyst for all problems in the selection and maintenance of portable tools.

Now ready: Wall charts with all the maintenance pointers on portable tools . . . AIR or HIGH-CYCLE. Free on request. Specify which type of tools you use.

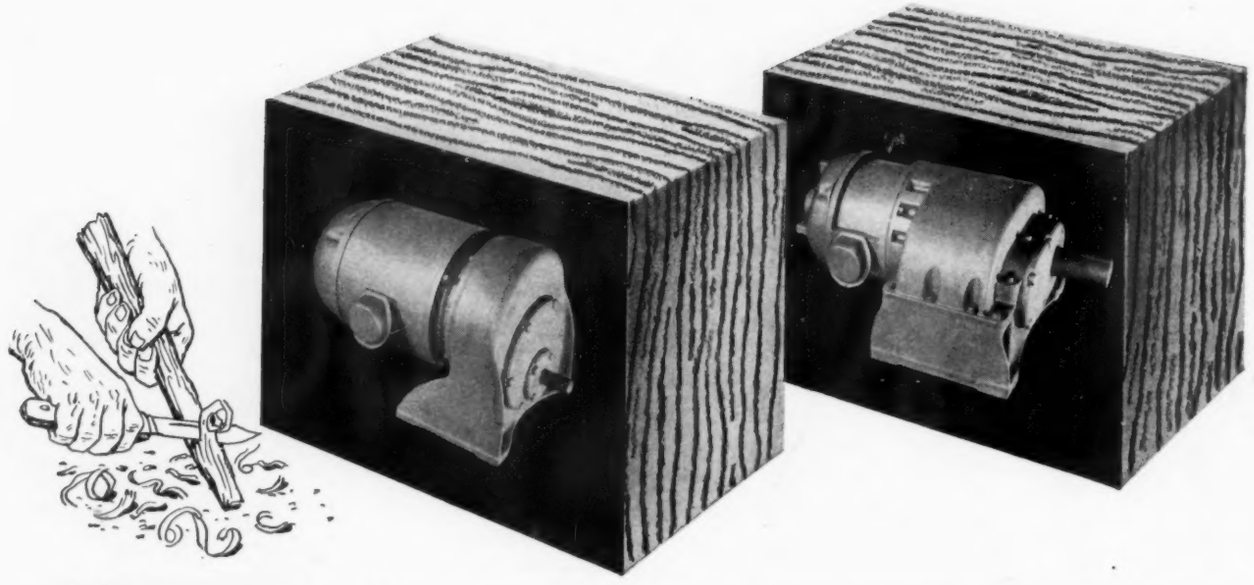
AIR

THE ROTOR TOOL CO.

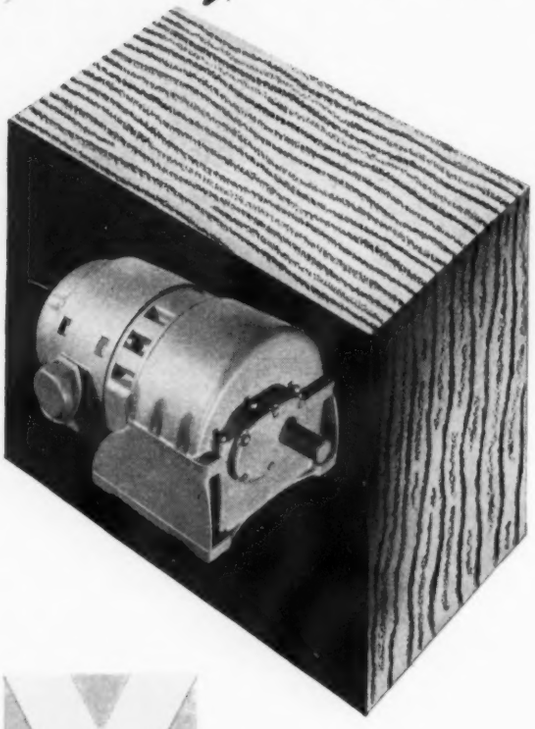
CLEVELAND, OHIO

HIGH CYCLE

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS



Whittling improved gearmotor design *out of wood*



Westinghouse makes two kinds of gearmotors these days . . . some of metal and others of wood.

The metal gearmotors go to fill your present orders, to furnish power for the war production drive. Wood gearmotor models reflect the shape of things to come, the improvements and refinements you can expect in the Westinghouse gearmotors you will buy in the immediate tomorrow.

And here's what you can expect when these wood models change to steel:

LOOK for a streamlined appearance that has practical advantages; an improved design that is more efficient, easier to install.

LOOK for a more adaptable construction that fits snugly against the machine it is driving and requires a minimum amount of space.

LOOK for improved application practices which match the gearmotor to the job to be done.

LOOK for simplified gearmotor design, conserving critical materials yet retaining ruggedness of construction.

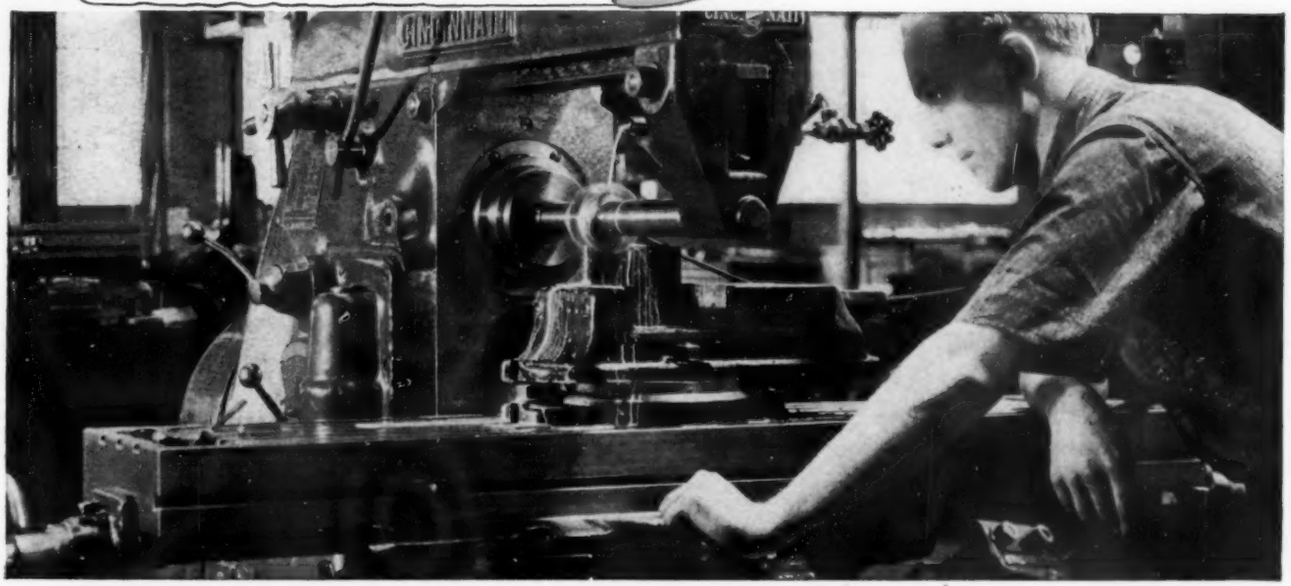
Westinghouse has the distinct advantage of designing, testing and building gearmotors as complete units. You have the assurance of knowing just how the motor and gear will perform *as a unit*. Ask your Westinghouse representative for recommendations on your slow-speed drive problems. Or write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-07202

GEARED FOR VICTORY

WESTINGHOUSE

Westinghouse
GEARMOTORS

CUT OUT CUTTING OIL PROBLEMS!



Have priorities forced you to use new and unfamiliar materials—each with its own new cutting oil problem?

Do you worry about damaged work, poor results and the resultant loss of precious time? *If so, then let a Cities Service cutting oil specialist help you.*

There is no obligation for this service.

Just drop us a line on your letterhead and ask that a lubrication engineer call. But for your own protection, do it *today*.

An informative booklet, "Metal Cutting Lubrication," will be sent upon request to the personnel of cutting oil users. Mail the coupon below for your copy.

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.
or any of the following offices:
CHICAGO . CLEVELAND . ST. PAUL
KANSAS CITY . BOSTON . TORONTO
or to
ARKANSAS FUEL OIL COMPANY
SHREVEPORT . ATLANTA . BIRMINGHAM

FREE! Just Clip and Mail

Please send me booklet on "Metal Cutting Lubrication." A.M.

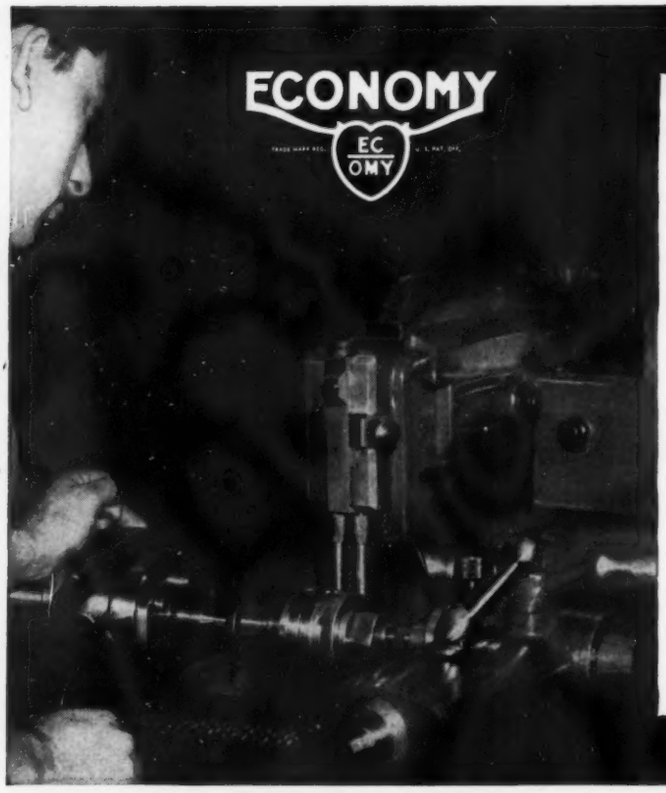
Name_____

Firm Name_____

Address_____

City_____ State_____

A LUBRICANT FOR EVERY INDUSTRIAL NEED



ECONOMY GRINDING OIL has revolutionized thread grinding practice.

Throughout the aircraft industry all highly stressed threads are ground on precision thread grinders for accuracy and fine finish with Economy No. 1654, helping to speed production.

ECONOMY GRINDING OIL permits your wheel to grind a true and accurate form.

When a large amount of metal is removed, ECONOMY GRINDING OIL allows the grinding of a thread in two passes, one rough, one finishing, and the surface of the ground thread possesses accuracy of form with the surface structure undisturbed.

New catalog E-18 well worth having. Yours for the asking.

THE WHITE & BAGLEY COMPANY

Detroit Worcester, Mass. Minneapolis

ECONOMY GRINDING OIL HAS REVOLUTIONIZED THREAD GRINDING PRACTICE

Positive action of BARRETT TYPHOON CENTRIFUGAL WASHERS provides for quick, thorough parts cleansing

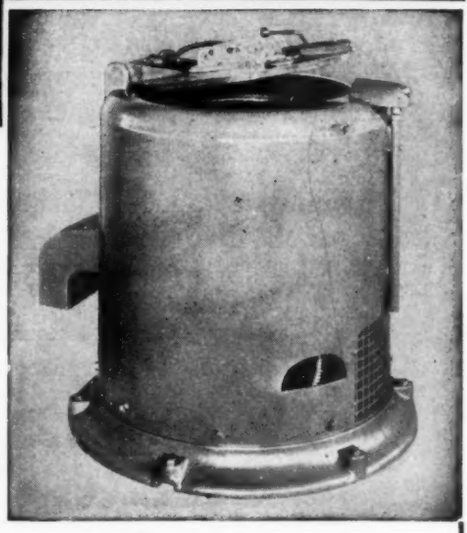
In these efficient centrifugal machines the washing solution enters the top of the whirling load under valve control. The operating principle—being that of a typhoon—gives the washing solution a spraying, swirling, and surging action which thoroughly permeates the contents. During this action, centrifugal force creates hydrostatic pressure within the basket. That proportion of the deluge going to the bottom is forced up the side and out carrying off the contaminated fluid.

A thorough, quick cleaning is definitely assured by flowing sequence. Two or more liquids may follow, making it possible to wash, rinse or provide any further treatment as required.

Several Barrett installations involve the use of four machines operated by one man who loads and unloads in three minute cycles. Washing time is only one minute. Another type of set-up provides for recovering oil, washing, drying, and coating with rust-proofing material.

As in all Barrett Centrifugal machines, provision is made for convenience and safety of operation.

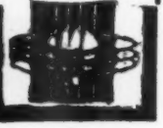
Send at once for details of Barrett Typhoon Washer



Barrett Centrifugal Washer — made in capacities from 13 to 38 cu. ft. per hour. Each size, depending on condition, will perform at the rate of 20 duty cycles per hour.

THE LEON J. BARRETT CO. WORCESTER, MASS.

Designers and Builders of Centrifugal Machinery



It's NEW

HELP FOR THE MAN ON THE MACHINE

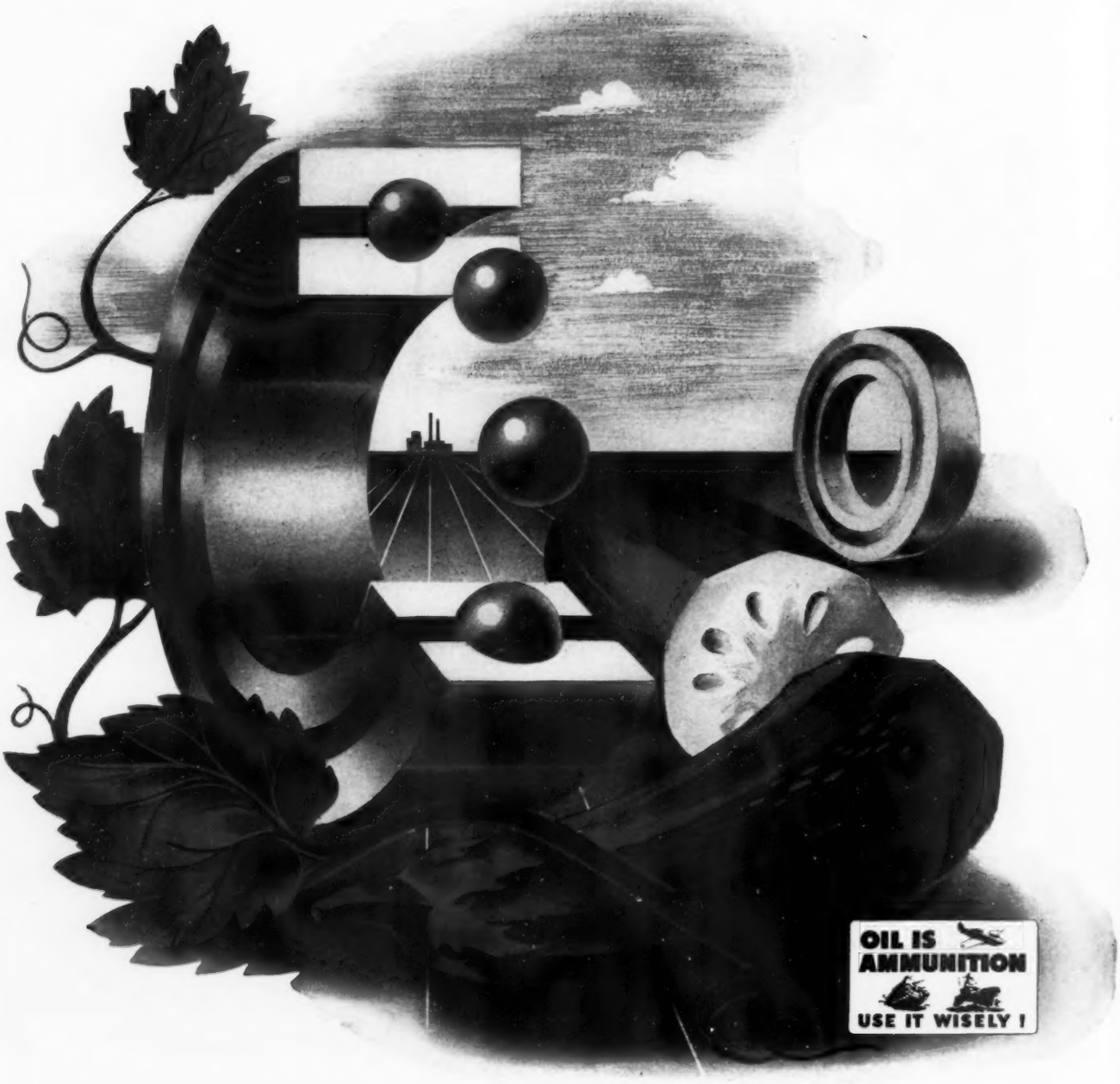
Tools for various machining operations, tool shapes, cutting speeds and feeds, cutting compounds, characteristics of the different Aluminum Alloys; all these things are discussed in this new book, "Machining Alcoa Aluminum".

Beginners and experienced machinists will find this book equally valuable. It may contain your key to faster, higher quality production of badly needed war materiel.

Alcoa engineers continue to be available to assist you in solving new and unusual Aluminum fabricating problems. They'll also gladly counsel with you on your postwar thinking. For this help, and for copies of this new book, "Machining Alcoa Aluminum", write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh, Pa.

ALCOA ALUMINUM

bearings keep cool



as a cucumber

since this plant switched to Tycol Green Cast Greases

"We gave Tide Water the toughest lubricating job in our plant, and it is doing it to our satisfaction," declares the chief engineer of this company. "It has smoothed out for us the troublesome problem of lubricating heavy mill bearings.

"Never since we started using Tide Water Green Cast Grease have we had a single bearing overheated – even though we have been operating 24 hours a day, six days a week. Our greasing problem has been reduced to simply filling the cups once every eight hours."

If lubricating problems hamper sustained operation in your plant, call in a Tide Water engineer. He will study your problem and recommend the proper Tide Water lubricant "engineered to fit the job." Write today for complete details to Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y.

DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

TIDE WATER ASSOCIATED OIL COMPANY
EASTERN DIVISION: 17 BATTERY PLACE, NEW YORK
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

"DO-S" AND "DON'T-S" FOR

FORD Tribloc MAINTENANCE

This is no time to abuse machinery. Because steel is so critical to America now, it is up to every one of us to make our present equipment last longer. That means proper maintenance. Here are a few simple things to do to keep your **FORD TRIBLOCS** in efficient working order:

- **Keep equipment well lubricated and in good repair.**
- **Don't exceed rated capacity.**
- **Inspect chain periodically and change when wear becomes excessive.**
- **Don't make lifts or pulls for which hoist was not designed or intended.**
- **Avoid dropping hoists or throwing chain about carelessly.**
- **Replace straightened hooks.**
- **Be sure the hoist has the capacity and characteristics necessary for the job.**
- **Proper hoist selection saves production time and lengthens hoist life.**

Write for information on **FORD TRIBLOCS.** They range in capacities from ¼ ton to 40 tons. They are available to all who have adequate priority rating.

Order from your distributor

FORD CHAIN BLOCK DIVISION
PHILADELPHIA • CHICAGO
SAN FRANCISCO

In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

Specialized FOR THE METAL INDUSTRIES

TURCO

Industrial Chemical COMPOUNDS

Turco Products, Inc., manufactures a line of industrial chemical compounds, specialized for various operations of production and maintenance in every industry. They are used for such operations as metal processing; preparation of surfaces for painting and plating; degreasing and decarbonizing of all kinds of machine parts; removal of and prevention of corrosions; maintenance of equipment and similar or related operations.

Among these, the products described below have been specialized for the metal industries.

•

TURCO W. O. #1 is a phosphatizing compound, which when applied in solution, cleans and passivates the surface of steel or aluminum. This passivated surface makes an excellent base for paint, and gives a high degree of adhesion. For full information, send for Bulletin #A-592-1-102.

TURCO AIRLION #81 cleans aluminum and other metal parts by hot tank immersion. Has potent alkaline reaction, but will not attack aluminum. Acts by wetting out but is soapless. "Maximum alkalinity with safety." For full information, send for Bulletin #A654-1-102.

TURCO PROSOLV cleans steel and brass by hot immersion. Not a soap, but yields a foamy lather that carries away soils by flotation. Dissolves the film-forming elements in hard water. Rinses freely. For full information send for Bulletin #A566-1-102.

TURCO POROKLEEN cleans steel before cadmium plating. Immersion in a hot solution of Turco Porokleen results in a chemically clean surface for further processing. Can be used either for still tank cleaning or electro-cleaning. For full information, send for Bulletin #A46A-1-102.

When writing for information or literature, give your name, address, firm and title or position.

TURCO PRODUCTS, INC.
LOS ANGELES • SAN FRANCISCO • CHICAGO
HEAD OFFICE: 6135 So. Central Ave., Los Angeles
Sales and Service Representatives and Warehouse Stocks in All Principal Cities

Factories in Los Angeles and Chicago

Better Bearings for *IMPROVED MACHINE TOOLS*

☆ Today the machine tool industry finds Bunting Bronze Bearings available as always and in advanced forms fully meeting war industry needs. Our Machine Tool Bearing Division is constantly aiding in the engineering of bearing applications in machine tools for precision work never before achieved in production. We can valuably aid you if you have such a bearing problem... The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

Bunting

BRONZE BUSHINGS • BEARINGS • PRECISION BRONZE BARS

WE CAN IMPROVE YOUR MARKING, TOO!

This NOBLEWEST Rapid, Precision Marking Machine speeds up the marking of Aircraft Engine Cylinder Barrels.

★ "One of the best machines that's come into the plant," exclaimed an official in one of the country's leading aircraft factories — does the stamping of identification numbers formerly requiring six men — and does it better. Inscriptions of uniform depth are obtained and marking tools last longer under controlled pneumatic pressure

This efficient NOBLEWEST Marking Machine, being equipped with casters, is wheeled to the work, thus making it unnecessary to route parts to a central marking machine.

Worth several times its cost alone by eliminating the nerve racking noise of hand stamping.

The model illustrated is but one of a complete line of NOBLEWEST marking equipment. We gladly design special purpose marking machines and our engineers will cooperate with you in the placement and use of NOBLEWEST marking equipment to obtain greatest overall marking efficiency and speed. Write us about your marking problems today. Your inquiry will receive prompt attention.

MARK IT BEST WITH NOBLEWEST® NOBLEWEST IMPROVED MARKING DEVICES

NOBLE & WESTBROOK MFG. CO. · EAST HARTFORD, CONN.

The coupon will bring you this new Filtaire Folder.

STOP THE DAMAGE CAUSED BY DUST AND DIRT · · · · *use the* Filtaire PORTABLE DUST COLLECTOR

The FILTAIRE Portable Dust Collector will soon pay for itself when used in conjunction with dry grinding and polishing operations. It is especially valuable in shops where no central dust collecting system is available. These portable units STOP THE DAMAGE caused by dust and dirt by cleaning all air through an inexpensive, replaceable, fireproof filter.

The Filtaire saves on the fuel bill too, because all clean air is recirculated inside—it does not exhaust valuable warm air out of the shop.

Clean air is safe air—get complete information on the FILTAIRE by mailing the handy coupon!

Please send me complete information on the Filtaire Portable Dust Collector.

COUPON

NAME ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... STATE .....

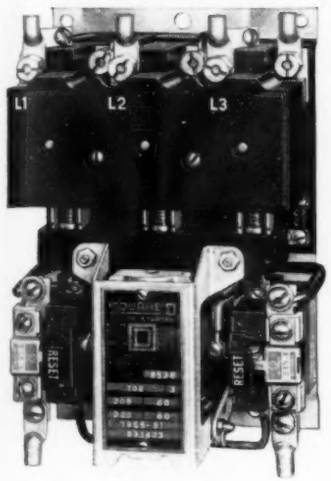
A.M.

EDWARD BLAKE COMPANY
634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

J-B TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS

Complete Accessibility

means faster, easier servicing of motor starters

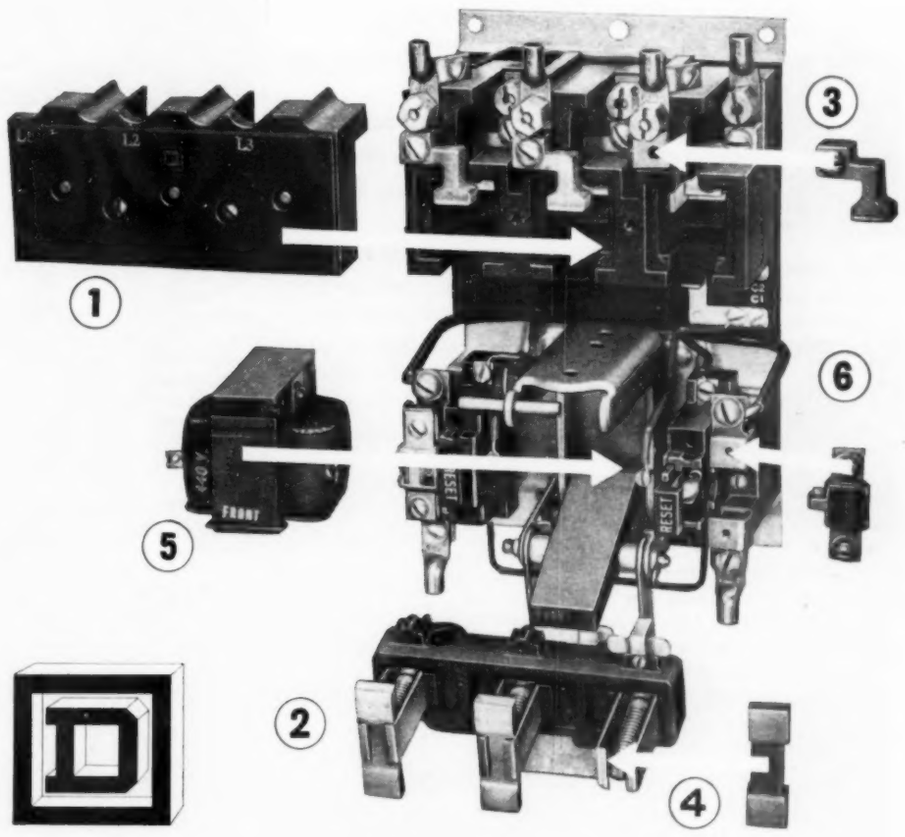


All renewable parts of Square D AC electric motor starters can be inspected or replaced in a matter of seconds—using only a screwdriver

Top operating efficiency and long life of electric motor starting equipment depend largely on regular inspection and occasional servicing.

Today—with every minute at a premium—this inspection and servicing job is more important than ever to avoid time-wasting breakdowns.

Square D Class 8536 AC magnetic starters, with their simple compact construction and vertical action, are completely accessible. An electrician, without special tools, can exchange magnet coils, contacts or overload relay units—in practically no time at all.



1 Both stationary and movable contacts are exposed for inspection by merely loosening two screws and removing the arc chamber cover.

2 With cover removed, movable contact yoke bar can be swung forward to uncover operating magnet and coil.

3 Each stationary contact is held in place by a single screw. Removal does not disturb line or load connections.

4 Movable contacts can be turned 90° and removed from retaining clips without tools. Movable as well as stationary contact tips are silver—require no cleaning or dressing.

5 With coil connections removed, magnet frame and coil are lifted out by sliding locking clips and retaining pin out of position.

6 Clearly marked melting alloy type thermal overload relay units—interchangeable to suit motor characteristics—are easily attached at either side of the starter. Heater, melting pot, and ratchet wheel comprise an integral unit. Repeated tripping causes no deterioration and no parts need to be renewed following overload.

WRITE FOR BULLETIN 8536

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

"Saving the day"

with . . .

Our Metallurgical Laboratory is available to determine the right combination of qualities you need in castings.

ABSCO MEEHANITE

Many manufacturers are today using ABSCO Meehanite Castings in place of steel castings, forgings and other scarce and strategic materials. They have found ABSCO Meehanite of vital importance under present operating conditions — many having found it a permanent improvement over former materials type of castings.

Through Our Selective Processing a Type of ABSCO MEEHANITE is Available to Fit Your Needs for any of these Qualities . . .

1. **Strength, toughness and high damping capacity.**
2. **Ability to stand shock or strain.**
3. **Free machining qualities.**
4. **Density and solidity for pressure castings.**
5. **Heat and corrosion resistance.**
6. **Freedom from warpage that means constant alignment.**
7. **May be heat-treated for higher tensile strengths and increased resistance to wear.**

COMPLETE CONTROL EQUIPMENT is one reason why we can give you just what you want in ABSCO Meehanite castings.

We will be glad to consult with you now.

ABSCO Meehanite Wheel Chart — provides full information about Controlled Qualities which enable ABSCO Meehanite to supply precisely the requirements needed for a wide variety of exacting casting work. Write for the wheel chart and other literature.

THE AMERICAN BRAKE SHOE AND FOUNDRY COMPANY

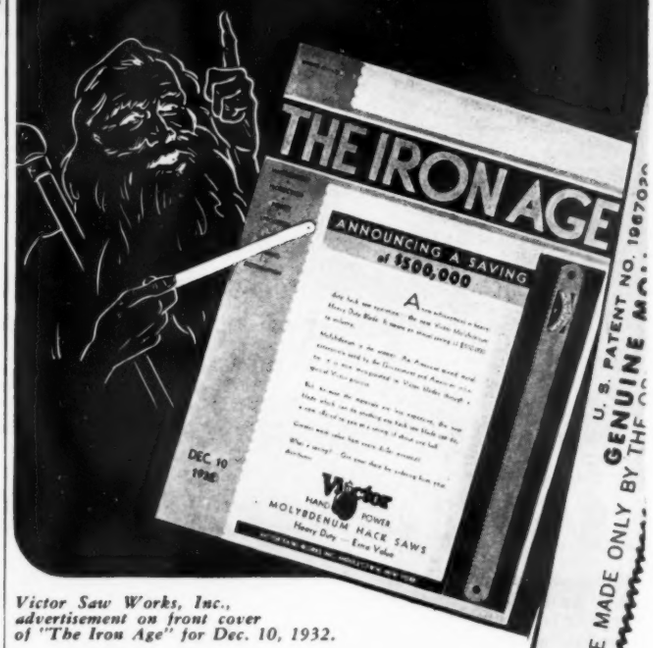
BRAKE SHOE AND CASTINGS DIVISION

FOUNDRY
MAHWAH
NEW JERSEY

OFFICES
230 Park Avenue, New York, N. Y.
332 South Michigan Ave., Chicago, Ill.

10 YEARS AGO

This blade solved today's metal sawing problem



Victor Saw Works, Inc., advertisement on front cover of "The Iron Age" for Dec. 10, 1932.

Ten years ago VICTOR introduced the first molybdenum alloy hack saw blade—bringing a tremendous saving in heavy duty metal sawing costs.

Today VICTOR "Moly"* High Speed—better by far in steel, heat treatment and uniformity—is being adopted by war production plants everywhere—with no impairment of cutting efficiency.

When you buy power or hand blades for high speed work, be sure to specify VICTOR "Moly"* High Speed—the original molybdenum alloy blade, unexcelled today. Look for the all-over gold metallic finish that identifies the genuine.

For awkward work, *it's VICTOR Unbreakable Special Flexible—that cuts like an all hard, yet cannot be broken in use in a frame. Green metallic finish.*

VICTOR SAW WORKS, INC.
MIDDLETOWN, N. Y.

581

VICTOR MOLY HIGH SPEED

ARE MADE ONLY BY THE GENUINE MO

U. S. PATENT NO. 1967

**T. M. Reg.—introduced and made only by Victor Saw Works, Inc., and affiliated companies.*

IT'S THE OFFENSE THAT WINS BATTLES

Since 1940, the Nazis have won battle after battle. Why? Because they've waged one offensive after another.

ALTER EGO: Yes, but they've been able to do that. They started their *war production offensive* 10 years ago so they had a big edge on us in tanks, planes and guns. Then we really started competing.

So competition forces progress. *Look how in two years, our* production offensive *has already surpassed that of the Axis—turning out better weapons and more of 'em. These new arc welded M-4 tanks, for example. They'll soon be in our fighting offensive.*

ALTER EGO: It's thrilling but don't let it get us complacent. Haven't we learned never again to be caught unprepared in war . . . or in *business competition* either?

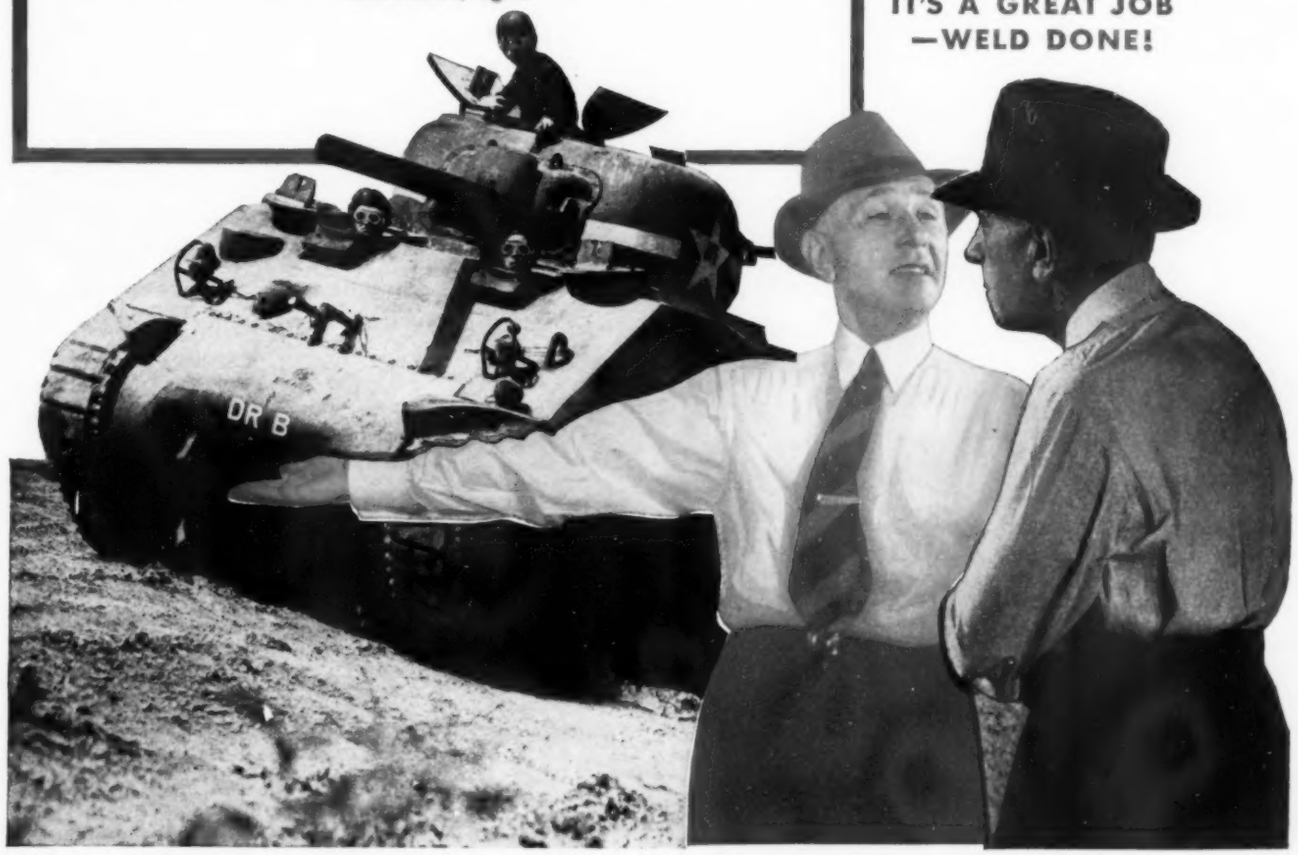
There you have it! Let's start TODAY waging a planning and designing offensive *so we'll be on the alert with better welded products and lower costs to get the upper hand on our competition the minute the post-war Battle for Business begins!*

Ask your inner self if it isn't the offense that wins battles.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

IT'S A GREAT JOB —WELD DONE!

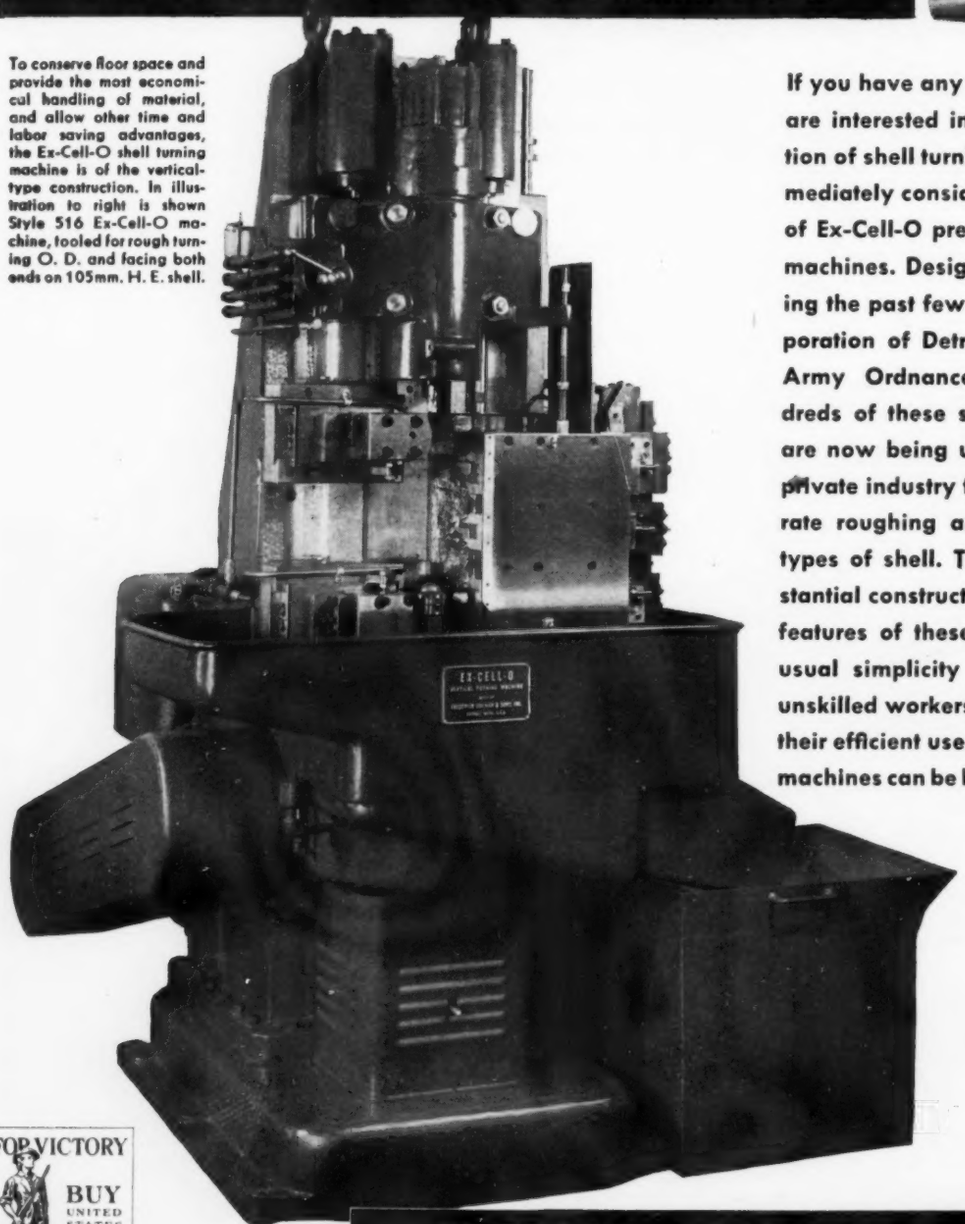


FOR *Fastest* SHELL TURNING

EX-CELL-O PRECISION MACHINES FOR ACCURATE AND SPEEDY PRODUCTION . . . ROUGHING AND FINISHING . . . 75 TO 155MM. SHELL

These Ex-Cell-O machines, which are constructed specifically with feeds and speeds for the most efficient use of cemented carbide tools, are being tooled for either rough turning and facing or finish turning all sizes and styles of shell . . . from 75mm. to 155mm.

To conserve floor space and provide the most economical handling of material, and allow other time and labor saving advantages, the Ex-Cell-O shell turning machine is of the vertical-type construction. In illustration to right is shown Style 516 Ex-Cell-O machine, tooled for rough turning O. D. and facing both ends on 105mm. H. E. shell.



If you have any shell turning problem, or are interested in the most rapid production of shell turning work, you should immediately consider the many advantages of Ex-Cell-O precision-built shell turning machines. Designed and developed during the past few years by Ex-Cell-O Corporation of Detroit, in cooperation with Army Ordnance representatives, hundreds of these single-purpose machines are now being used in government and private industry for the speedy and accurate roughing and finishing of various types of shell. The general design, substantial construction, and semi-automatic features of these machines provide unusual simplicity in operation, allowing unskilled workers to be trained quickly in their efficient use. In many instances, two machines can be handled by one operator.

For construction details, actual production figures, and early delivery dates, wire or phone *today* to Frederick Colman & Sons, Inc., Detroit, Michigan (Telephone TYler 4-3207).

FREDERICK COLMAN & SONS, INC.

7250 CENTRAL AVE., DETROIT, MICH.

Leave OFF the trimmings, and . . . they'll STILL do the job ! . . .

Suspenders and ball bearings have a lot in common! In most cases, the "trimmings" are only the *extras* dictated by personal tastes – contributing little or nothing to the efficient handling of the job at hand – while the simple, ungarnished "standards" adequately "hold up your pants".

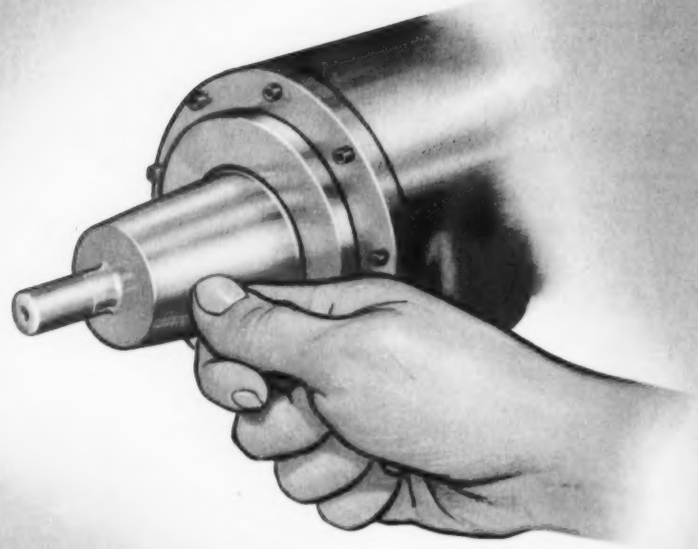
Standard Radial Ball Bearings, the backbone of the Fafnir Line, are made in the widest range of sizes to fit practically every installation. And in these times – when all ball bearing makers are working night and day on War orders, you can avoid the delays in delivery of "special" types when you specify Fafnir Standard Ball Bearings. You'll get the extra advantages of Fafnir's Balanced Design – larger balls, deeper races – which means greater radial and thrust capacity, and longer bearing life. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR

Ball Bearings

THE BALANCED LINE
FOR ORDNANCE AIRCRAFT AND
INDUSTRIAL MACHINERY

Take out PLAY- and stop CHATTER!



Fafnir builds ball bearings for high-speed precision work, with a life expectancy of thousands of hours! On shafts turning 40,000-60,000 r.p.m. and more – deflection, or "play" can be measured only in the millionths! You can put your thumbnail against shafts supported by Fafnir Super-Precision Ball Bearings, and not feel motion.

Incorporated in the design of new equipment, these Fafnir Bearings assure the finest precision work possible – and at speeds which permit maximum production. Case records of spindles, either originally-equipped or re-built with Fafnirs, substantiate all claims for increased quality and production as well as prolonged life of associated parts.

The skill and care in manufacture that makes these ball bearings possible is reflected in the quality of all Fafnir Ball Bearings. The Fafnir Bearing Co., New Britain, Conn.

FAFNIR

Ball Bearings

THE BALANCED LINE
FOR ORDNANCE, AIRCRAFT AND
INDUSTRIAL MACHINERY

Let a Meehanite Foundry
Solve Your Casting Problems

Ansonia, Conn.
Farrel-Birmingham Co., Inc.

Bridgewater, Mass.
The Henry Perkins Co.

Buffalo, N. Y.
Pohlman Foundry Co., Inc.

Charleston, W. Va.
Kanawha Manufacturing Co.

Chattanooga, Tenn.
Ross-Meehan Foundries

Chicago, Ill.
Greenlee Foundry Company

Cincinnati, Ohio
Cincinnati Grinders Incorporated

Cincinnati, Ohio
The Cincinnati Milling Machine Co.

Cleveland, Ohio
Fulton Foundry & Machine Co.

Denver, Colo.
The Stearns-Roger Mfg. Co.

Detroit, Mich.
Atlas Foundry Co.

Flint, Mich.
General Foundry & Mfg. Company

Hamilton, Ohio
The Hamilton Foundry & Machine Co.

Irvington, N. J.
Barnett Foundry & Machine Co.

Los Angeles, Calif.
Kinney Iron Works

Milwaukee, Wis.
Koehring Company

Mt. Vernon, O., Grove City, Pa.
Cooper-Bessemer Corporation

New York, N. Y.
The American Brake Shoe & Foundry Co.

Oakland, Calif.
Vulcan Foundry Company

Orillia, Canada
E. Long, Ltd.

Philadelphia & Bethayres, Pa.
H. W. Butterworth & Sons Co.

Philadelphia, Pa.
Florence Pipe Foundry & Machine Co., (R. D. Wood Company, Selling Agents)

Phillipsburg, N. J.
Warren Foundry & Pipe Corp.

Pittsburgh, Pa.
Meehanite Metal Corporation

Pittsburgh, Pa.
Rosedale Foundry & Machine Co.

Rochester, N. Y.
American Laundry Machinery Co.

St. Louis, Mo.
Banner Iron Works

St. Paul, Minn.
Valley Iron Works

London, Eng.
The International Meehanite Metal Co., Ltd.

Waterloo, N. S. W.
Australian Meehanite Metal Co., Ltd.

Johannesburg, South Africa
Meehanite Metal Co. (S.A.) (Pty.) Ltd

These QUICK FACTS about

Meehanite

may help you solve today's design and production problems

WHAT IS MEEHANITE?

MEEHANITE is a special metal for castings which combines the better features of both cast iron and steel. Meehanite castings offer the engineer reliable and favorable design characteristics as described below.

TYPES

There are twenty-one types of Meehanite, each having a different combination of physical properties aimed toward meeting definite service requirements.

PHYSICAL PROPERTIES

Varying with the requirements of the service, Meehanite in its several types (as cast) produces tensile strengths up to 55,000 lb. p.s.i.; compressive strengths up to 200,000 lb. p.s.i.; moduli of rupture in bending from 61,000 to 93,000 lb. p.s.i. These and other properties such as yield point, modulus of elasticity, hardness, torsonial and shear strength, fatigue strength, etc., are known and reliable.

HEAT TREATMENT

For higher strength and hardness, Meehanite is adaptable to heat-treatment and flame hardening. Accurate information is available on these subjects, as well as on the effect of elevated temperatures (50°F. to 1100°F.) on strength, creep, surface metal loss.

MACHINABILITY

Machinability rating tests prove Meehanite more machinable than steel or alloy iron castings. This important advantage of Meehanite is due to two factors, (a) the constitution of the metal frequently permits substantially increased machining speeds, (b) dimensional accuracy and smooth cast surfaces mean less metal need be removed in finishing.

VIBRATION DAMPING

A unique combination of high damping capacity and high strength gives Meehanite castings a prominent position in the construction of precision machinery, and in highly stressed machinery parts where weight, noise and possibility of fatigue failure must be kept to the minimum.

WEAR RESISTANCE

Five types of wear-resisting Meehanite offer different combinations of physical properties to meet external problems encountered in wear-resisting service such as: hardness, impact, fatigue, friction, corrosion, lubrication, etc.

HEAT AND CORROSION RESISTANCE

Where heat and corrosion resistance combined with high strength, toughness, etc., are desired, Meehanite is available in types to resist growth, scaling, warpage, and corrosion.

ENGINEERING DATA

Complete data on engineering properties, metallurgy, heat-treatment and manufacture is included in this 47-page book. Sent free to executives, engineers, designers, production and maintenance men of industry. Price to others, $1.00 per copy.

MEEHANITE RESEARCH INSTITUTE, 311 Ross St., Pittsburgh, Pa.

On Machines that Must Win the War!

Machines that turn out war equipment, must be built to withstand terrific production-pressure. Machinery builders can't afford to take chances with "doubtful" materials... faults might cause serious production set-backs. *Every integral part* must conform to rigid, pre-determined standards – and that is why Parker-Kalon Quality-Controlled Socket Screws are "on the *preferred* list" of many famous makers of production equipment!

P-K Socket Screws meet every test for physical and mechanical characteristics. "Doubtful screws" – screws that *look* all right but some of which fail to *work* right – are eliminated by a careful check-routine supervised by Parker-Kalon's Quality-Control Laboratory. Such protection is especially important throughout industry today – yet, it costs no more to specify *Parker-Kalon!* Parker-Kalon Corp., 194-196 Varick Street, New York, N. Y.

"Quality-Controlled" means . . . . . .

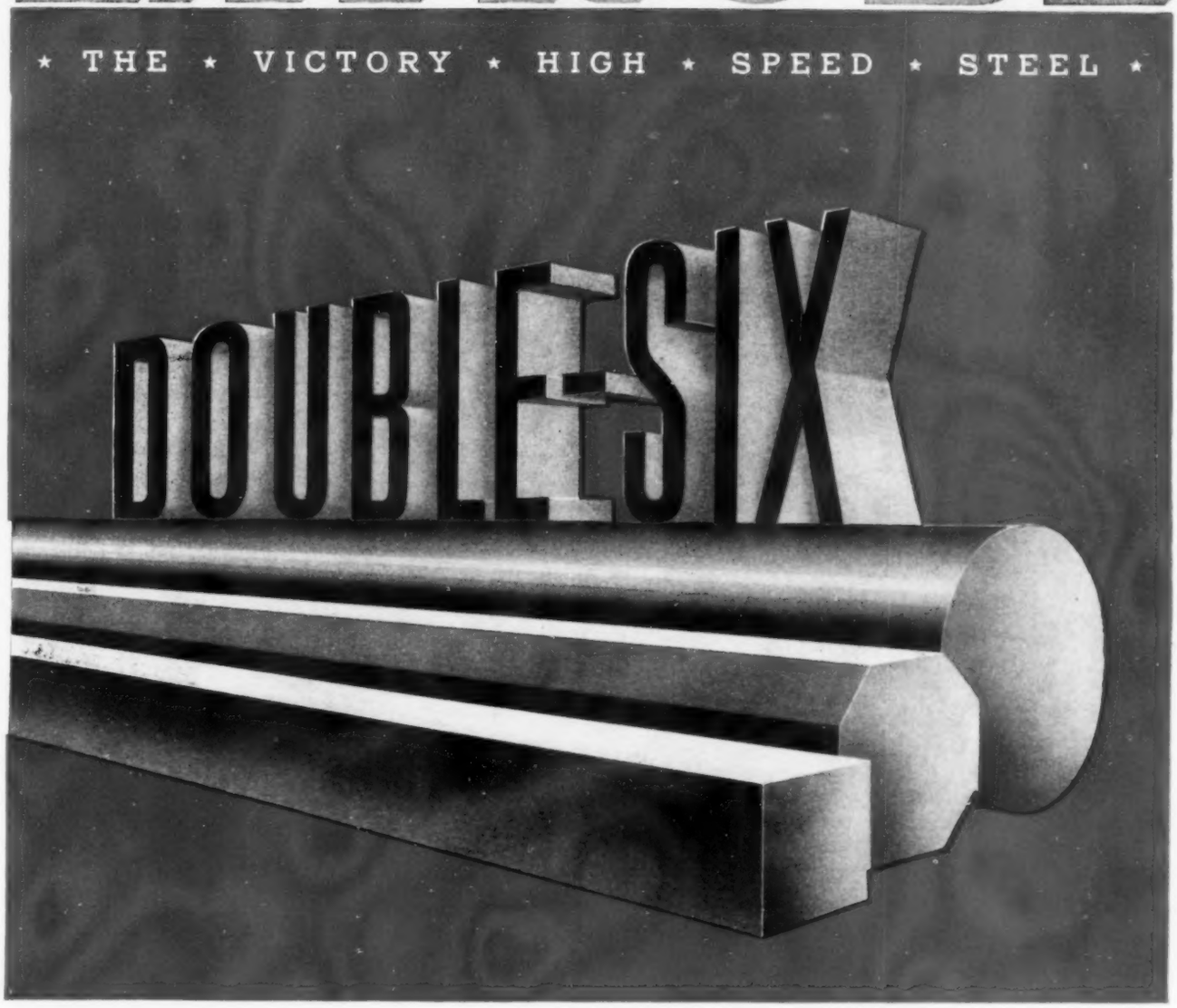
Complete test and inspection covering: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; and Thread fit.

PARKER-KALON
Quality-Controlled
SOCKET SCREWS

Give the Green Light to War Assemblies

LATROBE

★ THE ★ VICTORY ★ HIGH ★ SPEED ★ STEEL ★



★ Effects urgent savings in Tungsten, Molybdenum and Vanadium.

★ The superior Tungsten-Molybdenum high speed steel for all industrial cutting operations.

★ Can be readily heat-treated to attain maximum efficiency.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

LESCO

Write for Bulletin

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT ·· LATROBE · PENNSYLVANIA

REACH FOR A NEW HIGH IN
YOUR GRINDING PRODUCTION!
Armament production men working on "impossible" completion schedules appreciate more than ever the value of BAY STATE's consistently superior abrasive products. Such "engineered-in" features as Fractional Grades, Controlled Porosity, and H-9 Vitrified Bond have eased to a tremendous degree their great task of obtaining maximum output in minimum time, with ever-increasing grinding efficiency.
As a result of recent plant expansion and new tunnel kiln, deliveries are now better than ever. Use BAY STATE products for greater production!
Send for practical reference book containing a wealth of information on all types of grinding, including Foundry Wheels, Cut-Off Wheels, Mounted Points, Internal Wheel Recommendations, etc. Widely used for training apprentices, new operators and students. Yours on request.
BAY STATE
WHEELS of PROGRESS
BAY STATE
BAY STATE
BAY STATE
BAY STATE
ABRASIVE PRODUCTS CO., WESTBORO, MASS. U.S.A.

REEVES VARIABLE SPEED DRIVES

provide these Vital, Hard-Hitting Advantages

1 **FULL RANGE SPEED ADJUSTABILITY**—not just steps in speed but any speed between predetermined limits — maintained without slippage and without fluctuation as long as desired. Speed changes effected without stopping driven machine.

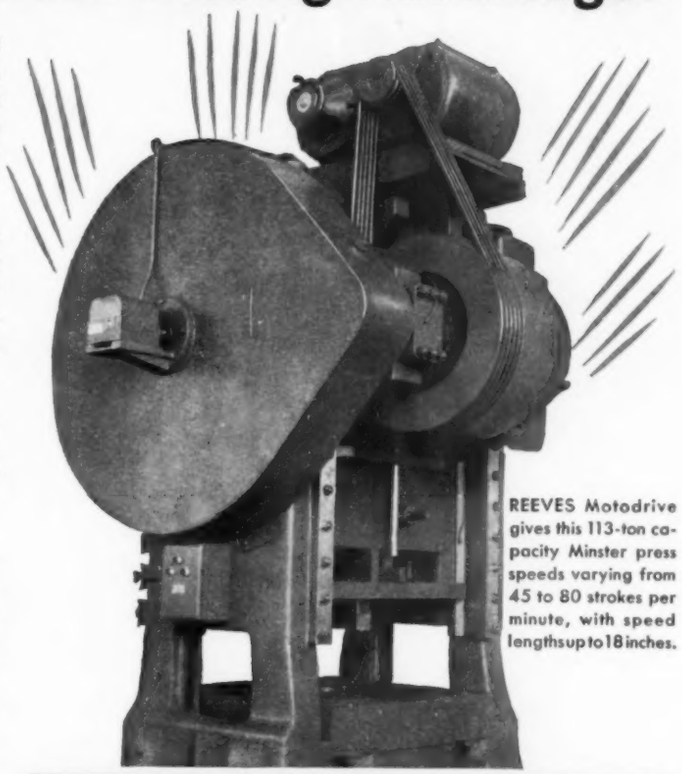
2 **MANY ADAPTABLE UNITS** in one complete line, providing infinite speed flexibility over a wide range and available in many types of controls—manual, electric remote and completely automatic, the latter by electrical, mechanical or hydraulic methods.

3 **OPERATING PRINCIPLE PROVED** in 210,000 installations, including use as standard equipment by builders of 1,440 different makes of machines.

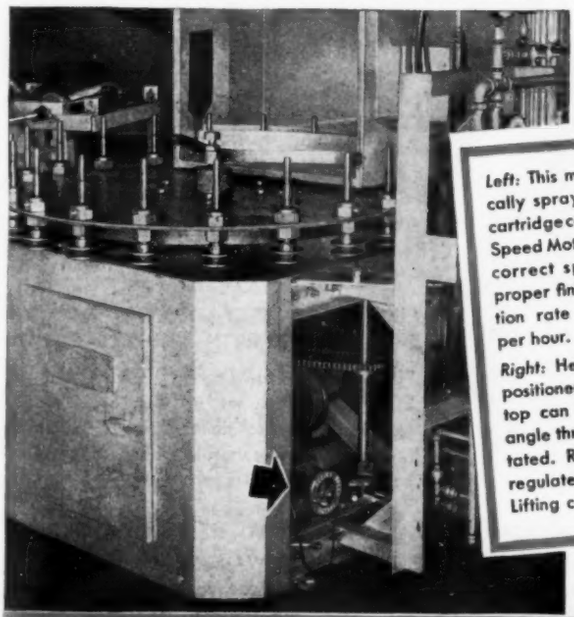
4 **NATION-WIDE ENGINEERING SERVICE,** consisting of seasoned speed control engineers located in 36 leading industrial centers to help you choose the best unit and apply it correctly.

Send for copy of 20-page booklet A-423, "More Output for Victory with REEVES Variable Speed Control."

REEVES PULLEY COMPANY, COLUMBUS, INDIANA

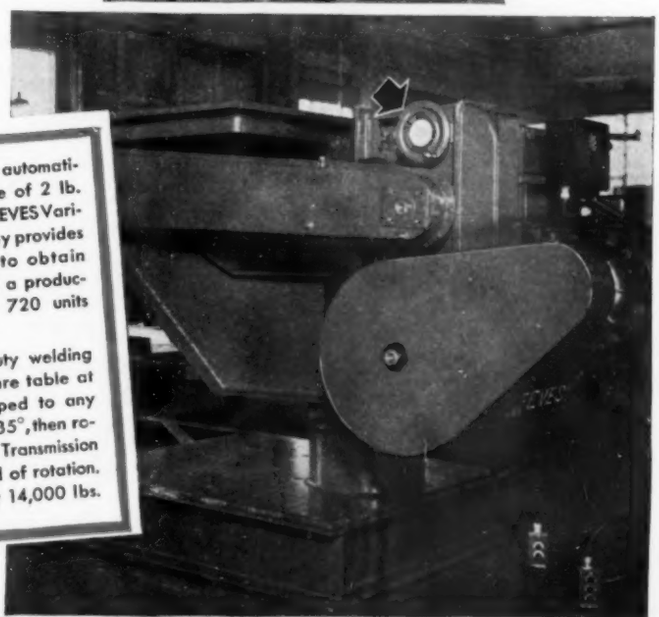


REEVES Motodrive gives this 113-ton capacity Minster press speeds varying from 45 to 80 strokes per minute, with speed lengths up to 18 inches.



Left: This machine automatically sprays inside of 2 lb. cartridge cases. REEVES Vari-Speed Motor Pulley provides correct speeds to obtain proper finish and a production rate up to 720 units per hour.

Right: Heavy duty welding positioner. Square table at top can be tipped to any angle through 135°, then rotated. REEVES Transmission regulates speed of rotation. Lifting capacity 14,000 lbs.



REEVES *Accurate Variable* Speed Control

FREE There is much valuable and helpful information in the "Unbrako" Screw Products Catalog. Send for a copy today.

Choose and use "Unbrako" Screws. They're unbelievably strong, accurately made and free from burrs. Deliveries are better than average. Start today to get the advantages from using "Unbrako" Screw Products. Complete range of sizes from #4 to 1½" diameter.

"UNBRAKO" SELF-LOCKING HOLLOW SET SCREWS WITH KNURLED POINTS

"UNBRAKO" *Self-Locking* HOLLOW SET SCREW — When set up like ordinary set screws, the *knurled points* "dig in" and hold the screw tight—regardless of vibration. Can be used again and again.

U. S. & Foreign Pat'd & Pat's. Pend'g.

***KNURLED* "UNBRAKO" SOCKET HEAD CAP SCREWS**

Knurled SOCKET HEAD CAP SCREW—*Knurling* prevents finger slip, saves time. Knurling also permits *locking* after countersinking.

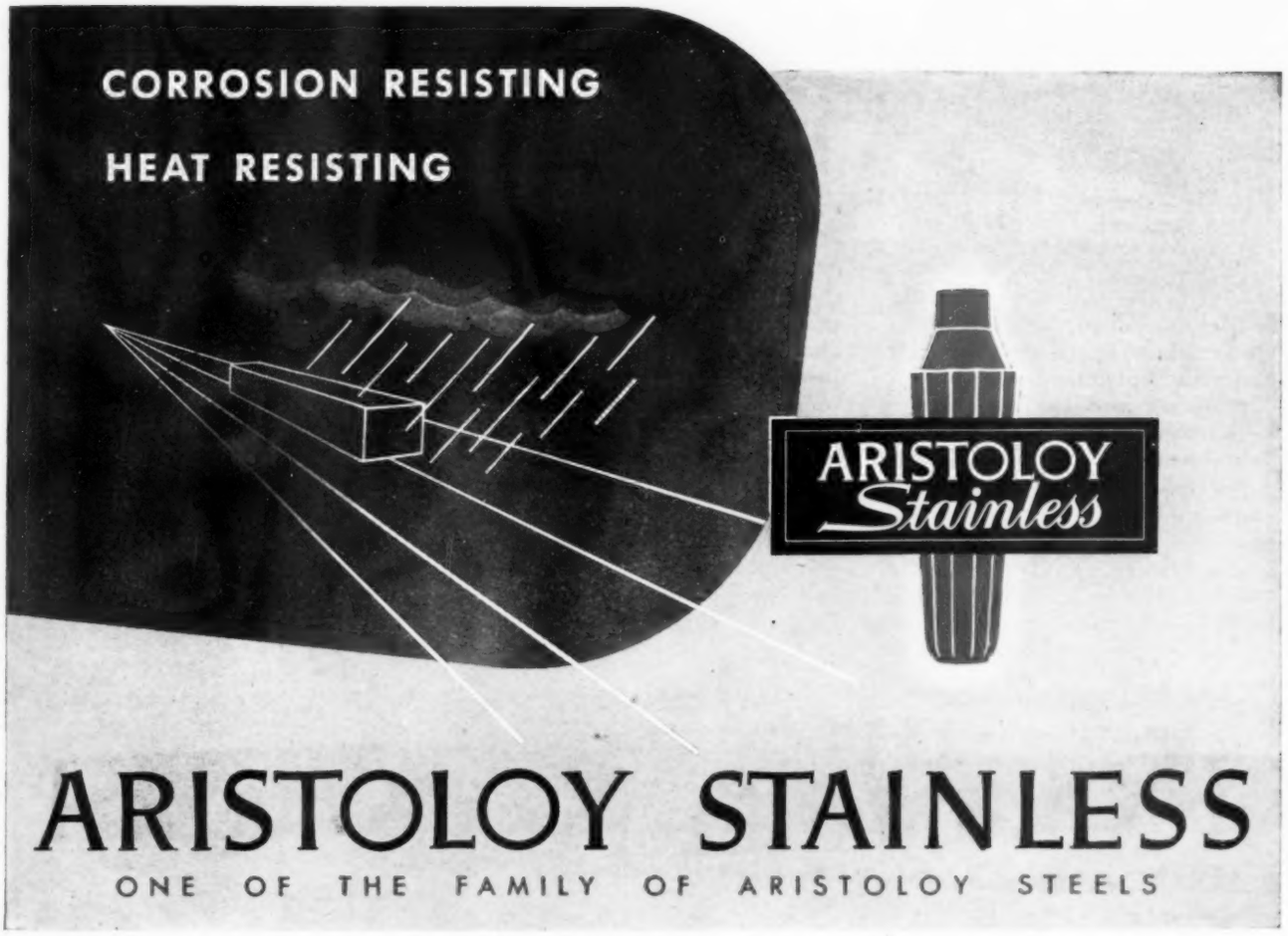
The Knurling of Socket Screws originated with "Unbrako" years ago.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 4

— BRANCHES —

BOSTON • DETROIT • INDIANAPOLIS
CHICAGO • ST. LOUIS • SAN FRANCISCO



ARISTOLOY STAINLESS

ONE OF THE FAMILY OF ARISTOLOY STEELS

To conserve nickel and chromium, all industry is cooperating to limit the use of stainless steels to vital applications where only stainless will do the job. For such applications Copperweld Steel Company is furnishing Aristoloy Stainless steel bars and billets. We'll be glad to discuss your stainless steel applications with your engineering staff.

COPPERWELD STEEL COMPANY **WARREN, OHIO**

A STAB IN THE BACK...

It took a stab in the back and a global war to teach an industrial America that only by grubbing, scrimping and saving can we keep weapons flowing to the combat zones of two hemispheres.

So, today, while grubbing and scrimping may not be the American ideal of life, we of Dayton who serve all industry know (as you do) that it is one of our big jobs. And we know, too, that improperly applied and carelessly checked V-Belts can slow down production on huge machines, increase maintenance costs, and *needlessly* waste irreplaceable time and precious materials.

If you are in doubt about proper V-Belt application or maintenance procedure—or if you have any unusual problems concerning V-Belts, your nearest Dayton V-Belt distributor will gladly give you helpful suggestions or service. And if you'd like extra copies of "Dayton's 9 life-saving rules for V-Belts," suitable for posting on bulletin boards, write to

THE DAYTON RUBBER MFG. CO.
The World's Largest Manufacturer of V-Belts
DAYTON, OHIO

DAYTON RUBBER EXPORT CORPORATION
38 Pearl Street New York, N. Y. U. S. A.

THROW YOUR SCRAP INTO THE FIGHT!

Dayton V Belts

LIFELINES OF POWER VITAL TO VICTORY

Copyright, 1942, The Dayton Rubber Manufacturing Co.

THE GREATEST NAME IN V-BELTS

40 MEN AND A JEEP

"GETTING there fustest with the mostest men" is still rule one for winning a battle. Today's wars depend upon the speed with which troops and their fighting equipment can be moved to the place where they are needed.

Rolling off production lines in America's great aircraft factories are huge freighters of the airways—planes as big as a boxcar that can span a continent between daylight and dark.

These leviathans of the air owe their tremendous carrying capacity as well as the speed with which they fly to the giant engines that power them.

To transmit the power of thousands of horses to whirling propeller blades, the gears in these engines must of necessity be held to such close tolerances that engineers have long considered them a laboratory product.

But laboratory methods of production could not be expected to furnish enough gears for the thousands upon thousands of fighting planes, bombers, and transports that are required to win a war.

The solution came in the production of gears of laboratory precision by mass methods, and today in the precision gear plant of Foote Bros., modern industrial might is helping solve the problem of more horsepower for engines—produced in ever-increasing quantities to meet war's insistent demands.

These new techniques—these new skills translated into post-war production mean that peacetime speed reducers and peacetime gears will assure better machines—quieter machines—that promise greater savings to American manufacturers.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

FOOTE BROS.

SPEED REDUCERS * GEARS * SPECIAL ASSEMBLIES

GEARS

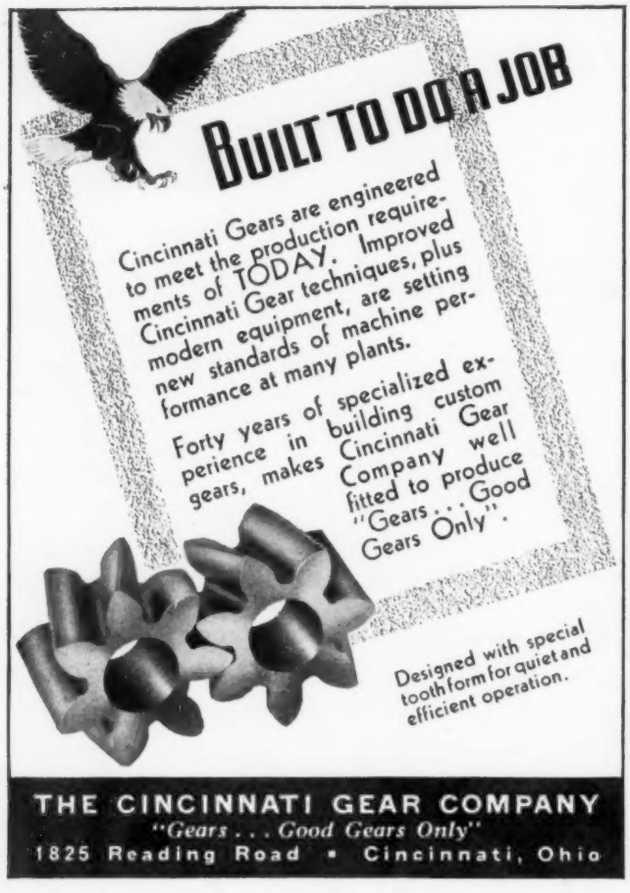
SPIRAL BEVEL • HYPOID • HELICAL • SPUR
WORM • HERRINGBONE • DIFFERENTIALS

ABILITY to handle rush jobs . . . special jobs . . . big jobs . . . small jobs . . . all kinds of jobs *smoothly, efficiently,* and *economically* has long made Fairfield headquarters for a vast quantity of production of gears for makers of trucks, tractors, construction machinery, industrial machinery, agricultural machinery, etc.

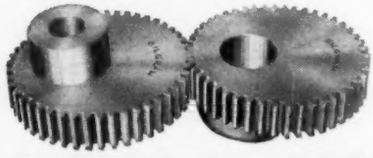
TODAY, this special ability is aiding many producers of war goods in their drive to "Beat the Promise!"

FAIRFIELD Mfg Co.

307 S. EARL AVE. LAFAYETTE, INDIANA


BUILT TO DO A JOB
Cincinnati Gears are engineered to meet the production requirements of TODAY. Improved Cincinnati Gear techniques, plus modern equipment, are setting new standards of machine performance at many plants.
Forty years of specialized experience in building custom gears, makes Cincinnati Gear Company well fitted to produce "Gears . . . Good Gears Only".
Designed with special tooth form for quiet and efficient operation.

THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
1825 Reading Road • Cincinnati, Ohio



ELLIPTICAL GEARS
Also Other Non-Circular Gears

ALL TYPES OF GEARS

BILGRAM GEAR & MACHINE WORKS
1217-35 Spring Garden St. Philadelphia, Pa.

FINE GEARS of All Types and Sizes
Spur Gears—½ in. to 30 ft. in diameter
Bevel Gears—½ in. to 13 ft. in diameter
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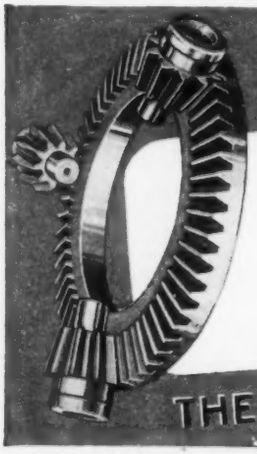

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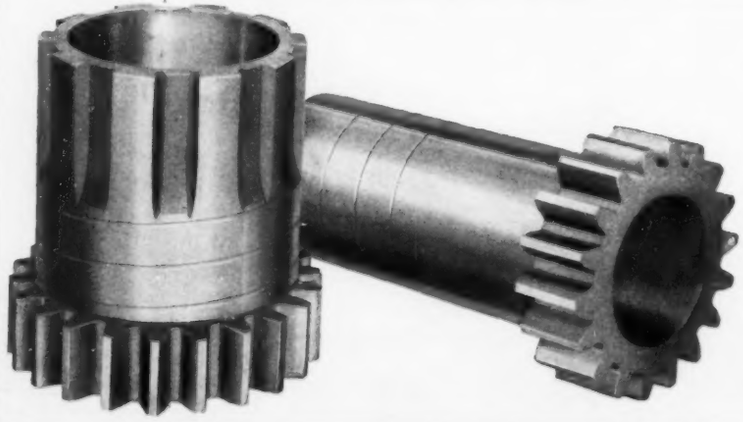

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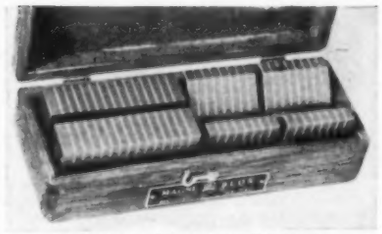

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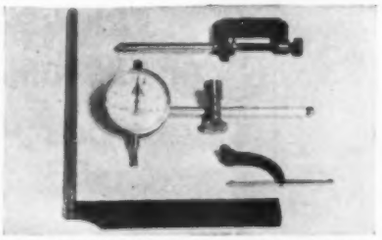

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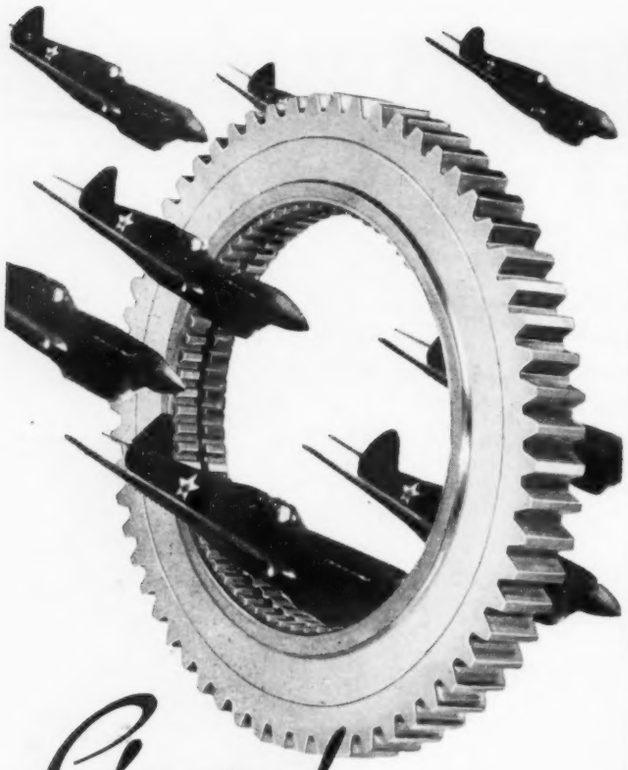

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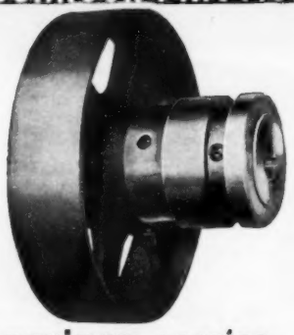

Left — Single Clutch with pulley.

Johnson expanding ring type.

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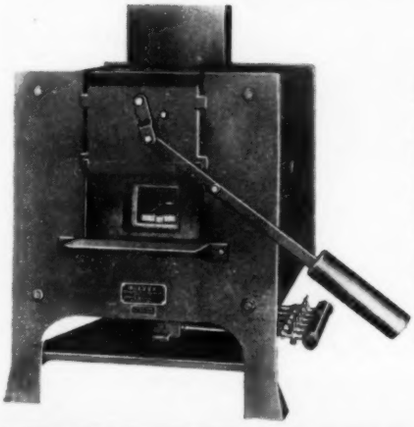

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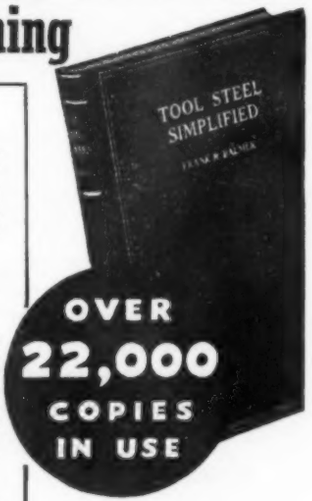

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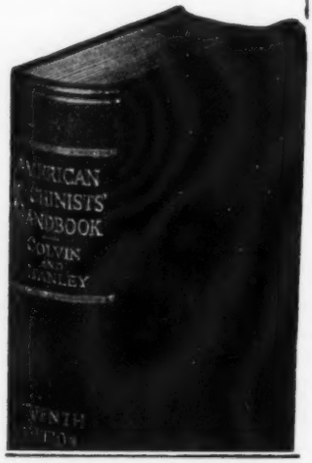

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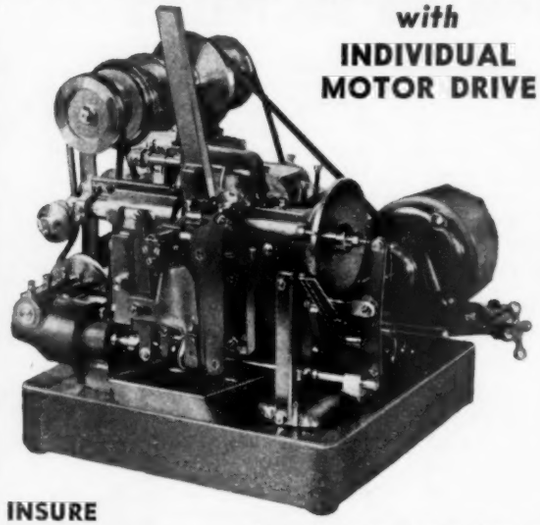

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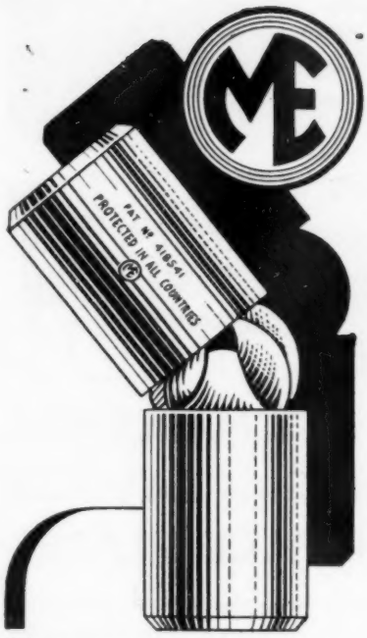

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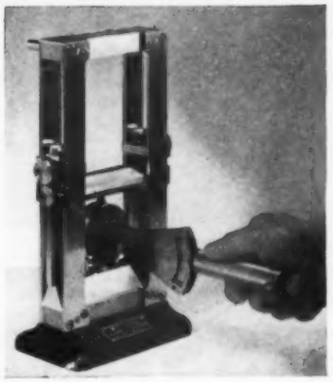

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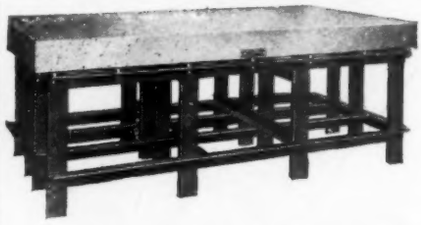

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The war has carried the engineering age to a new peak! Production demands have created technical problems the like of which the world has never seen before! The services of engineers are at a premium. Especially the services of one particular class—executive engineers—*engineers with business training;* engineers who can "run the show."

In these critical times, the nation needs engineers of executive ability *now, today* —not five, or ten years from now! The shortage of such men is acute—even more acute than that of skilled production workers. And company heads, aware of this situation, are offering high rewards to engineers who have the necessary training in industrial management.

Golden Opportunity for Engineers

In this new era, the engineer with vision and foresight has a golden opportunity. He will realize that out of today's tremendous production battles will emerge technical men who not only will play a major role in winning the war, but who also will be firmly entrenched in key executive positions when peace comes.

However, before the engineer can take over executive responsibilities, he must acquire knowledge of the other divisions of business—of marketing, accounting and finance. He has of necessity a vast amount of technical training and experience. But in order to grasp the opportunities that present themselves today—to assume leadership on the production front—he must *also* have an understanding of practical business principles and methods.

The Alexander Hamilton Institute's intensive executive training can give you this essential business training to supplement your technical skill. It is a time-saving program that fits into the most crowded schedule. It is not intended for men who expect to remain just engineers for the rest of their lives. It is for those willing to train for the position that now seems just a little beyond them—the position which will increase their incomes today and make their security more certain when the war has ended.

134,000 men on the operating side of business have enrolled for this training. More than 37,500 are technical men—engineers, chemists, metallurgists—many of whom are today heads of our huge war industries.

This training appeals to engineers because it gives them access to the thinking and experience of the country's great business minds. It is especially valuable to such men because it is basic, not specialized—broad in scope, providing a thorough groundwork in the fundamentals underlying *all* business. It covers the principles that every top executive must understand. It applies to all types of industrial organizations, because all types of organizations are based on these same fundamentals.

Business and Industrial Leaders Contribute

The Institute's training plan has the endorsement of leading industrialists and business men. And it is only because these high-ranking executives recognize its value and give their cooperation that such a plan is possible. Among those who contribute to the Course are such men as Frederick W. Pickard, Vice President and Director, E. I. DuPont de Nemours & Co.; Thomas J. Watson, President, International Business Machines Corp.; James D. Mooney, President, General Motors Overseas Corp.; Clifton Slusser, Vice President, Goodyear Tire and Rubber Co. and Colby M. Chester, Chairman of the Board, General Foods Corp.

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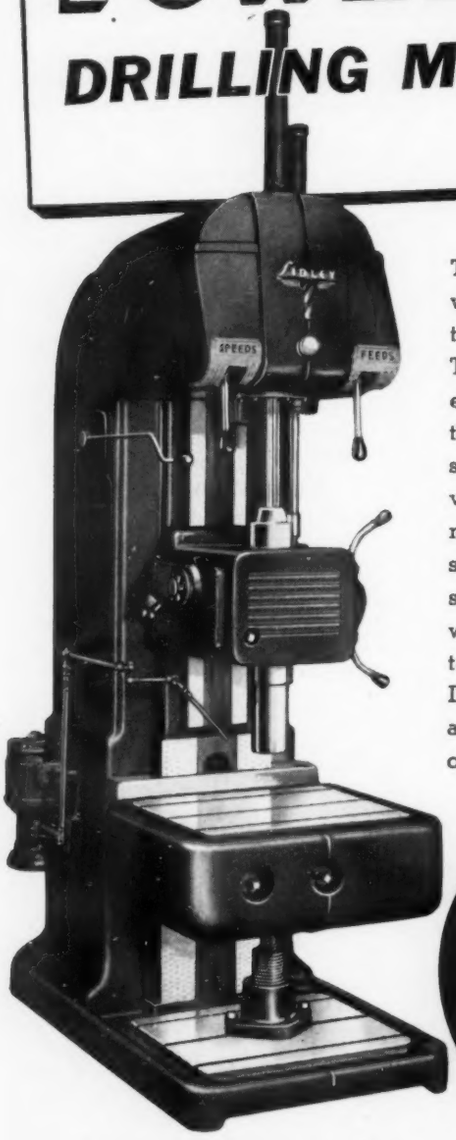
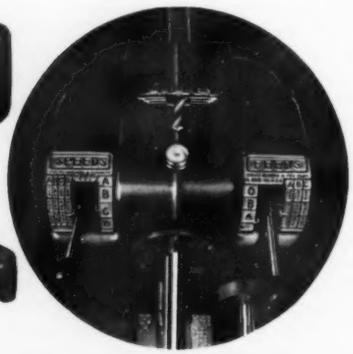


Today's tough drilling on war work doesn't bother users of the Sibley 25" Geared Drill. The tremendous power and extreme accuracy built into this machine make it well suited for armor plate and various hardened steels. Will maintain a selected feed and speed under heaviest pressure. Straight production work is held to the closest tolerances, and the Sibley Drill's ease of control makes it adaptable to frequent change-over on small quantities.



HERE'S WHY ACCURACY AND POWER ARE ASSURED IN THE SIBLEY DRILL

★ Geared drive with alloy steel, heat-treated gears in oil bath. Horizontal shafts mounted on anti-friction bearings.

★ Controls centered in front. Instant change of feeds and speeds.

★ 12 spindle speeds from 75 to 1500 RPM. 9 feeds from .005" to .045".

★ Tapping by electrical reversing switches.

★ 10 splined spindle operated by power and hand feed.

SIBLEY MACHINE AND FOUNDRY CORP.
8 EAST TUTT ST., SOUTH BEND, INDIANA

Westinghouse

FLEXARC FACTS

REJECTION ZERO

(Reading Time . . . 40 Seconds)

In 1940—when Henry Ford's "bomber an hour" was a general's dream—a company manufacturing printing presses bid to build gun carriages for Uncle Sam.

. . .

Time-worn ideas about rivets, bolts and castings went into the ash can—welding machines, positioner tables and electrodes replaced them on the production line.

. . .

October, 1942—the printing press assembly line, with a near Houdini touch, has become a flow production line for big, sturdy gun carriages.

. . .

Westinghouse A.C. Welders and positioner tables keep quality at a peak—make rejects a rarity—cut power costs to an enviable low. Production is exceeding the Company's most optimistic estimates.

. . .

The men behind the men behind the guns report that their welding machines bite into "hard to reach" corners, and easily weld heavy gauge steel—require no maintenance. And there's absolutely no magnetic arc blow.

. . .

During early stages of production, each weld was X-rayed. There were—"No rejects in 800 pieces."

. . .

Similar weld production is possible in your plant. Get complete facts. Write today for this new catalog on Westinghouse A.C. Arc Welders.

Westinghouse Electric & Mfg. Co.
Dept. 7-N, East Pittsburgh, Pa.
J-70391

DEGREASE AND CLEAN ALL YOUR WAR PRODUCTS

...the fast, performance-proved OAKITE WAY

BEFORE painting, lacquering or applying black, corrosion-resistant finishes . . . or before spot-welding, electro-plating, anodizing, tinning or galvanizing operations . . . you will find specialized Oakite alkaline, emulsifying, acid and solvent-type degreasing and cleaning materials provide the FAST, uniform, trouble-free results your war production schedule requires.

Used in automatic washing machines or tanks, these dependable Oakite materials keep rejects down, keep production lines flowing smoothly by thoroughly, speedily removing oil, grease, smut, soldering fluxes, polishing and buffing compounds and other deposits. See list below for types of war work on which Oakite materials are specified and used by prime and sub-contractors.

War-Time Oakite Service FREE!

Whether or not you are now using Oakite materials, all our facilities . . . our Nation-Wide Field Staff, our Chemical Research and Mechanical Engineering Laboratories . . . are freely available, day or night, to render helpful service on any war production degreasing or cleaning operation you want performed FASTER and EASIER! Your inquiries invited . . . no obligation.

IS THE WAR SUPPLY ITEM YOU ARE PRODUCING LISTED HERE?

Over 60 different Oakite materials are available that meet every production degreasing or cleaning specification on war orders. Prompt delivery assured from nearby warehouse stocks.

AIRPLANES
AIRPLANE MOTORS
FLIGHT INSTRUMENTS
AIRPLANE PARTS
BOMB FIN ASSEMBLIES
BOOSTER CAPS
FUZES & FUZE PARTS

POWDER BOXES
CARTRIDGE CASES
SHELLS
SHELL CASES
FLARE BOMB CASES
DEMOLITION BOMBS
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PRACTICE BOMBS
GRENADES
LAND MINES
FIRE-CONTROL INSTRUMENTS
COMMUNICATION EQUIPMENT
RIFLES
SMALL ARMS AMMUNITION

GUN PARTS
MACHINE GUN MOUNTS
ANTI-AIRCRAFT GUNS
TRENCH MORTARS
HOWITZERS
MOTORCYCLES
MOTOR SCOOTS

SCOUT CARS
TANKS
TRACTORS
TRANSPORT TRUCKS
GAS MASKS
HELMETS
ETC.

Manufactured only by
OAKITE PRODUCTS, INC., 24 Thames Street, NEW YORK, N. Y.
Representatives in All Principal Cities of the U. S. and Canada

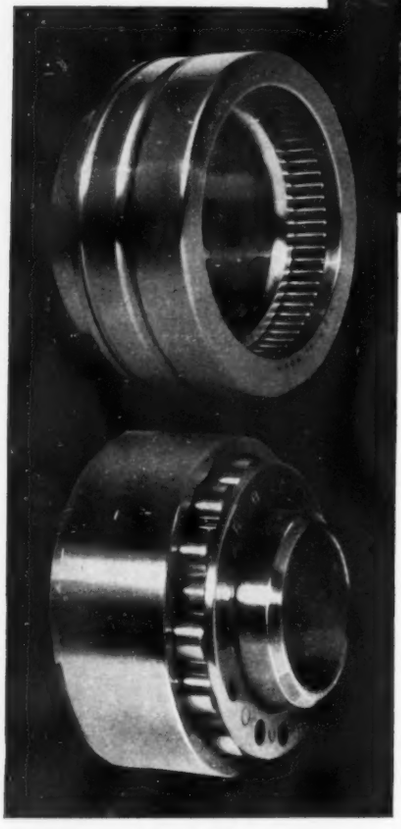
OAKITE Specialized CLEANING

MATERIALS...METHODS...SERVICE — FOR EVERY CLEANING REQUIREMENT

LETOURNEAU USES RBC

ROLLER BEARINGS TO HELP MOVE THE EARTH

LeTourneau Model C Tournapulls used to rebuild 5 miles of a Washington State Highway above Grand Coulee Dam. During a 21 day period the Model C hauled 420 loads on a round trip haul of approximately 3600 ft. A LeTourneau Dozer on a Caterpillar Tractor is used as a pusher for Tournapull loading. Total yardage: 300,000 yds.



Wherever LeTourneau earthmoving equipment is used—building vitally needed roads or clearing the jungles for new air bases—you can look for top results. RBC Roller Bearings, both the CYCLOPS and HEAVY DUTY types shown here, are used almost exclusively on sheave applications of LeTourneau Carryalls, Scrapers, Bulldozers, Angledozers, Pushdozers, Cranes, Rooters and Root Cutters together with the all important Power Control Units. They are also used in the Tournapull Reverse Gear and in the Case Group.

Such heavy service demands the high load carrying capacity provided by RBC Bearings whose solid inner and outer races as well as the rollers are manufactured from high carbon alloy bearing steel.

Send for Catalog with Complete Engineering Data

ROLLER BEARING CO. of AMERICA

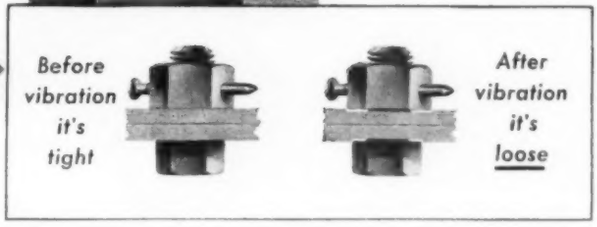
TRENTON . . . . NEW JERSEY

LET'S SPIKE A NUT

. . . to prove a point!

DRIVE A SPIKE right through both nut and bolt, so the nut can't budge. Now vibrate the assembly just as it would vibrate in ordinary use.

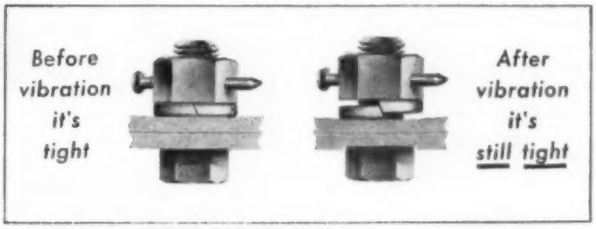
HERE'S WHAT YOU GET



—the nut did not move, but the strain and vibration of metal on metal wore the other parts loose—dangerously loose. Wear by abrasion, and *bolt stretch* etc. *loosen every vibrating part.*

Now keep the spike in but add a strong Kantlink spring washer,—then vibrate it just as you did in the first test!

HERE'S WHAT YOU GET NOW



Yes, still tight, because the strong Kantlink spring reaction held it tight. The Kantlink Spring washer expanded exactly as fast (and as far) as the inevitable *wear tended* to loosen the parts.

There is no substitute as economical. No fixed nut nor any short range multi-toothed washer can possibly equal the great holding power of a *wide-range live spring*—a big helical spring such as Kantlink.

Let us send you samples—send details of your application. Test and compare them on the same job with *any* type of nut, or with any other *type* of washer. Kantlinks can't lose a real test. Try them for efficiency, economy and real safety.

Write today for descriptive folder.

THE NATIONAL LOCK WASHER COMPANY
NEWARK, N. J., U. S. A.

KANTLINK TRADE MARK

the long-range Spring Washer

WEATHERHEAD
FITTINGS AND HOSE *Meet Vital Needs*

On plane—on ship—on tank—on truck—on machine equipment—wherever power, fuel and oil lines must be kept functioning—Weatherhead fittings and hose meet vital demands of industry.

BRASS TUBE FITTINGS
A complete line of tube service parts made from extruded brass rod free from porosity. Inverted, S. A. E. and compression types with square finish that makes installation easy.

FLEXIBLE FUEL LINES
Oil-proof—gasoline-proof—vibration-proof. Supplied as complete assemblies or in lengths with wide variety of easily attached fittings.

PACKLESS VALVES
Leak-proof; quick acting; sturdy; low overall height; natural grip hand wheel; full capacity openings; excellent for fuel lines.

ERMETO SAFETY FITTINGS
For tubes of any metal. Hold up beyond the burst strength of the tube itself. Provide safe, strong, dependable tube joints. Easily connected and disconnected. No flaring, soldering, welding or threading required.

★ ★ ★

Tell us the Weatherhead products in which you are interested and we'll send complete details.

THE WEATHERHEAD CO. • CLEVELAND, OHIO

WEATHERHEAD
TUBE FITTINGS • VALVES • DRAIN COCKS • AVIATION, AUTOMOTIVE AND REFRIGERATION SPECIALTIES

at vital points

At all points of attack in mechanized war, mechanical strains and vibrational stresses reach new highs. At the same time, Allen Hollow Screws reach new highs of *resistance* to these stresses.

Your "Allens" HOLD. They are steeled to hold, threaded to hold, hardened to hold. They make fast your machine assemblies with a weld-like rigidity at the critical points.

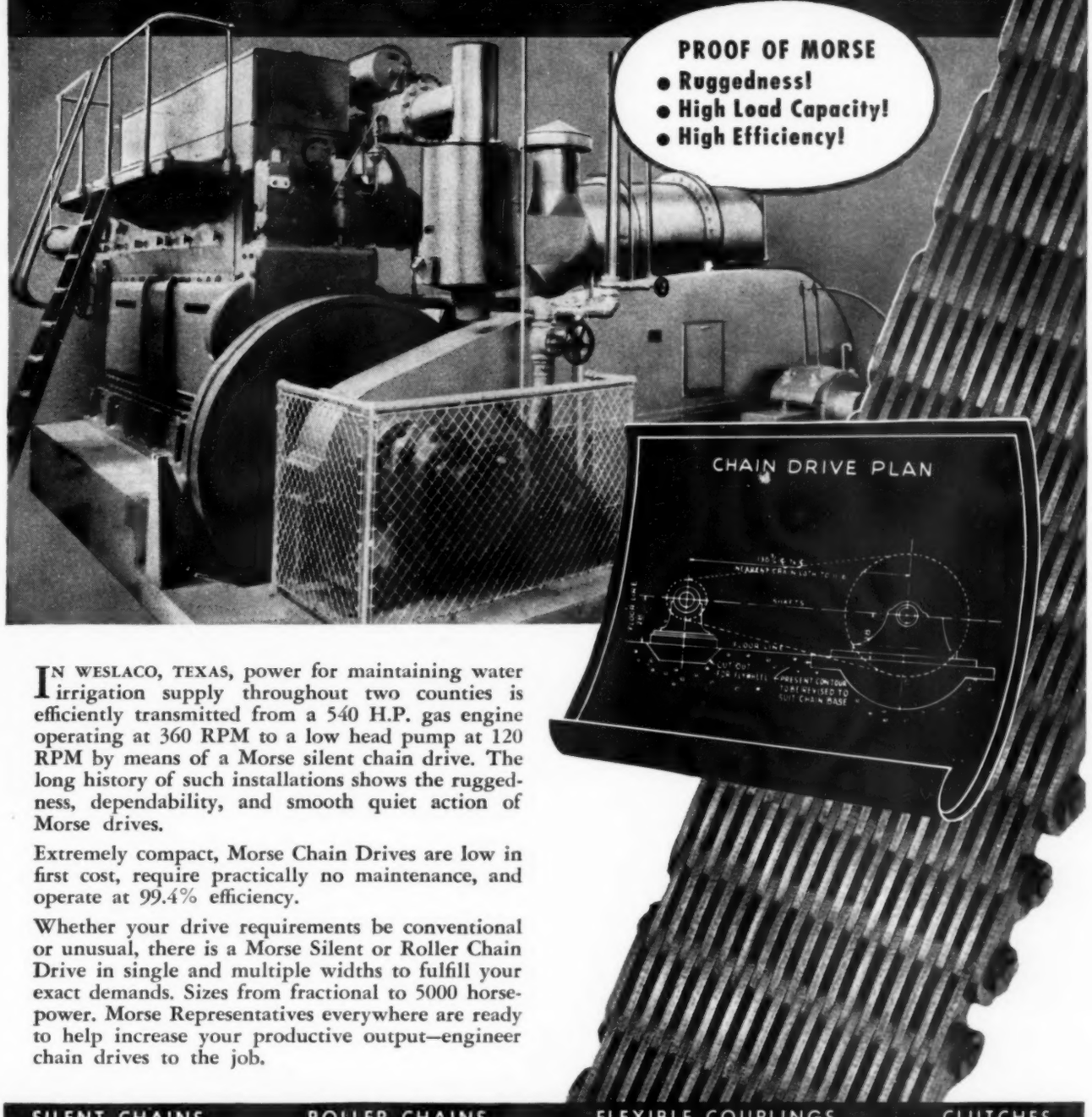
Better hold *exclusively* to the hollow screws that for 32 years have been toughened to "take it" *NOW!*

Your local Allen Distributor will secure for you the largest shipments compatible with your priorities and our intensified production-effort.

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.

TEXAS too, keeps the Pressure Up

500 H.P. Water Pump driven with MORSE SILENT CHAIN DRIVE...



IN WESLACO, TEXAS, power for maintaining water irrigation supply throughout two counties is efficiently transmitted from a 540 H.P. gas engine operating at 360 RPM to a low head pump at 120 RPM by means of a Morse silent chain drive. The long history of such installations shows the ruggedness, dependability, and smooth quiet action of Morse drives.

Extremely compact, Morse Chain Drives are low in first cost, require practically no maintenance, and operate at 99.4% efficiency.

Whether your drive requirements be conventional or unusual, there is a Morse Silent or Roller Chain Drive in single and multiple widths to fulfill your exact demands. Sizes from fractional to 5000 horsepower. Morse Representatives everywhere are ready to help increase your productive output—engineer chain drives to the job.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP

Tool Conservation begins in the Tool Crib

A PLACE FOR EVERY TOOL...

In the conservation of tools, their proper care in the tool crib is just as important as their proper use. Tools misplaced, lost or damaged through poor housekeeping methods are out of production just as completely as those worn out or broken on the machine.

Note the conspicuous aisle and section locating discs, and drawer numbers. Corresponding symbols on the requisition, copied from a card index, enable even new employees to locate unfamiliar tools quickly.

Photo Courtesy Pratt & Whitney Aircraft

The direct labeling method is handy for departmental cribs or for the small shop.

Photo Courtesy American Bosch Corp.

and EVERY TOOL IN ITS PLACE

Increased production schedules mean more calls at your tool crib windows with a probability of more delays in handling "Window Traffic". Systematic layout of aisles, shelves, drawers and compartments will assure that every tool is where you want it when you want it.

• • •

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASSACHUSETTS

DETROIT PLANT: 5850 Second Boulevard

WAREHOUSES in New York, Chicago and Los Angeles

IN CANADA: GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

ARMY E NAVY

GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

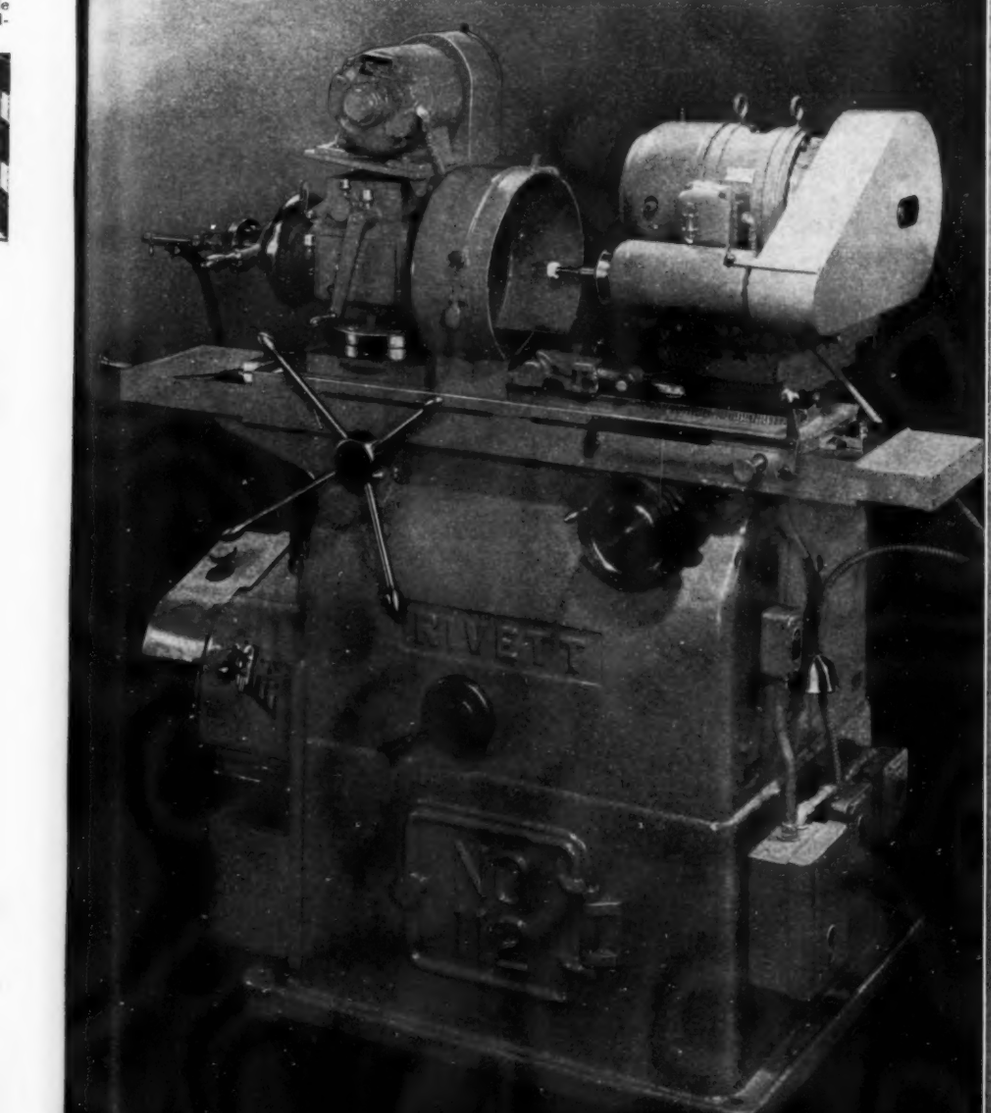
RIVETT

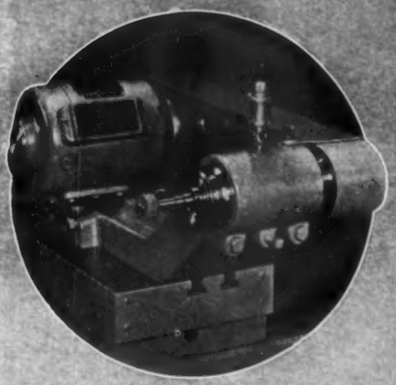
112 UNIVERSAL GRINDER

For Straight, Taper, Bevel or Straight and Bevel Grinding

The Rivett No. 112 Universal Precision Grinder is primarily for tool-room work. Available internal and external spindles in combination with many adjustments make possible a great variety of grinding operations. Extreme simplicity of design enables any mechanic familiar with grinding to operate the machine.

Work may be held in collet, step chuck, jaw chuck or fixture and driven at required speed. Power table reciprocation may be set at one of eighteen selective speeds, from 40 to 86 passes per minute. Length of table travel is [illegible] adjustable between ½" and 8". High or low speed internal spindle bracket, or external spindle bracket, all as illustrated, may be [illegible] mounted as required on cross slide. Workhead, table and cross slide are swivelled individually or in combination for taper and bevel grinding.





High Speed Internal Spindle

External Spindle and Tailstock

SPECIFICATIONS

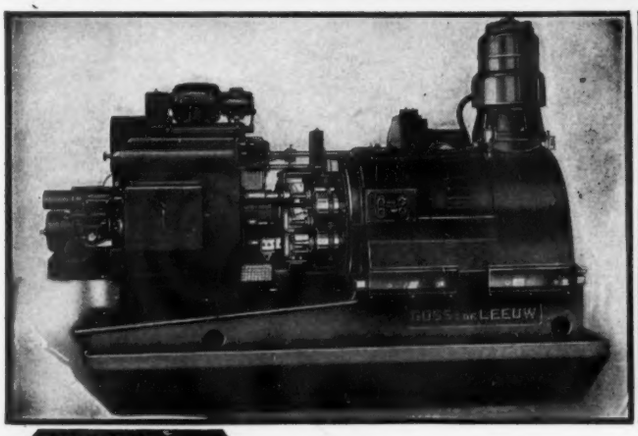
Grinding cap., hole dia.	⅛" to 8"
Grinding cap., outside dia.	up to 8"
Automatic table travel	½" to 8"
Table speeds	18 selective
Hand table travel	16"
Swing over table	14"
Workhead swivel	90°
Table swivel	5°
Cross slide swivel	90°
Cross feed graduations	.0005"
Travel of cross slide	3½"
Collet capacity	1"
Step chuck capacity	8"
Jaw chuck capacity	8"
Workhead spindle speeds	150, 380, 600 r.p.m.
Grinding spindle speeds:	
Standard int.	4600 and 10000 r.p.m.
High speed int.	25000 r.p.m.
External	3300 r.p.m.
Automatic Oil Lubrication	
Net weight with motors	3700 lbs.

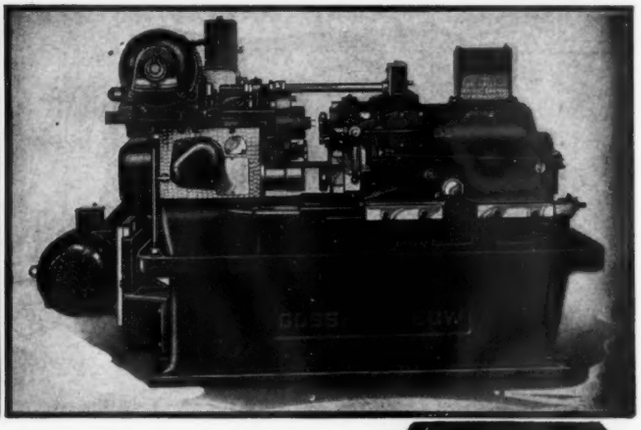
For Further Description Write for Bulletin 112

112 UNIVERSAL GRINDER

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES





WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

Features include:

Lead Screw Threading on both types—Pre-loaded Anti Friction Spindle Bearings—Hardened Ways—Oversize Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

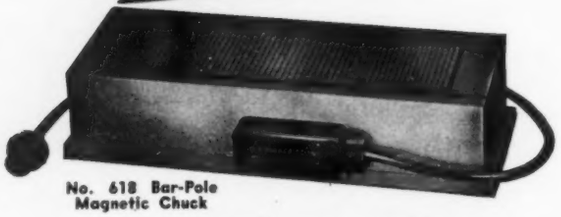
Write for copy of descriptive catalog giving complete, detailed specifications.

TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

WALKER MAGNETIC CHUCKS

there's a WALKER for YOUR needs



No. 618 Bar-Pole Magnetic Chuck

Universal Swiveling Magnetic Chuck

You are sure to find the magnetic chuck that will exactly fit your requirements when you come to Walker. There's no guesswork because Walker makes all types and sizes, including Rectangular, Swiveling, Vertical Face and Rotary designs.

Then, too, you are assured of having magnetic chucks that are the product of long, specialized experience — chucks that are designed and built right for the specific service intended.

If you need special chucks for special purposes, Walker can supply them promptly and at reasonable prices.

You'll save time and money by specifying "Walker" on your next magnetic chuck order.

Style "D" Face Plate "Concentric Gap" Type

FULL DETAILS ON REQUEST

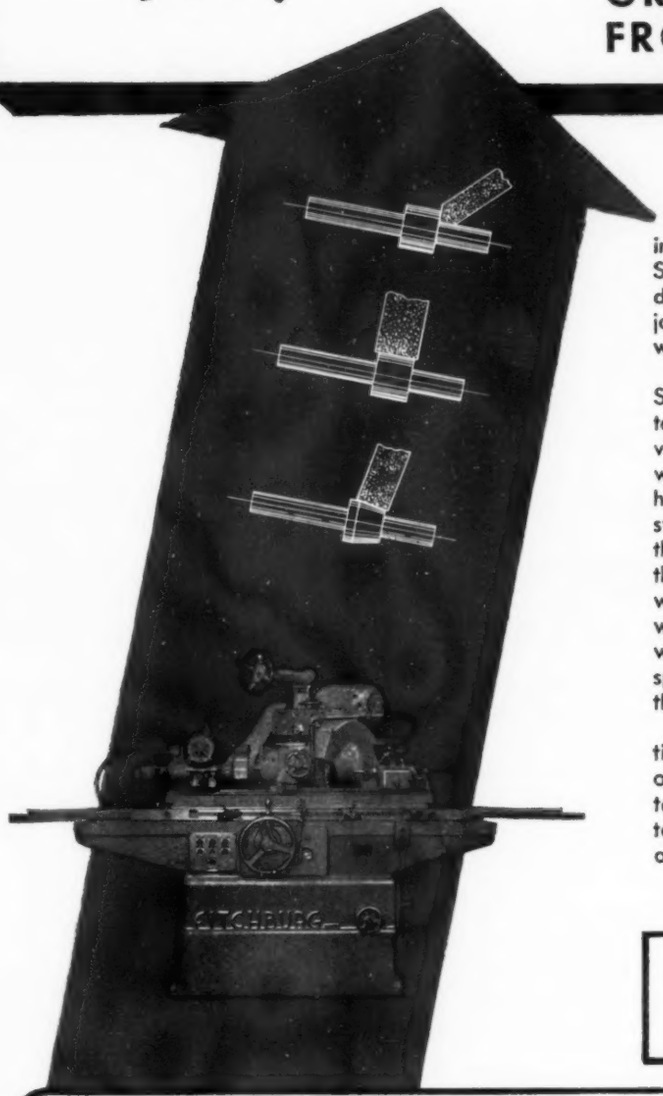
Ask for circular W-4

O.S. WALKER CO. INC. WORCESTER, MASS.

New FITCHBURG ADJUSTABLE "TYPE C"

Angular Head Grinder

FOR PLAIN CYLINDRICAL GRINDING . . . . . FROM *0 degrees to 45 degrees*



The Fitchburg Adjustable "Type C" Angular Head Grinding Machine is another single application of the Fitchburg Standard Bowgage Wheelhead Unit. The "Type C" is designed to handle a wide range, and a number of types of jobs. In finding ways to cut your grinding time and costs it will pay to consider what this machine can do.

This newest of Fitchburg plain cylindrical grinders has a Standard Wheelhead Unit mounted so that it may be located to grind from 0 degrees up to a 45-degree angle. Previously angular head grinding machines have been equipped with fixed heads for single purpose grinding. The Bowgage head on the Fitchburg "Type C" is adjustable and can be swivelled to various positions for standard plain grinding, thus providing greater grinding utility. The head goes through a completely automatic cycle — rapid traverse to work, correct feed, grinding dwell and rapid return. The workhead is adjustable for various lengths of work and the work spindle can be equipped for single or variable work speeds. The trueing device is hand operated and mounted on the work table.

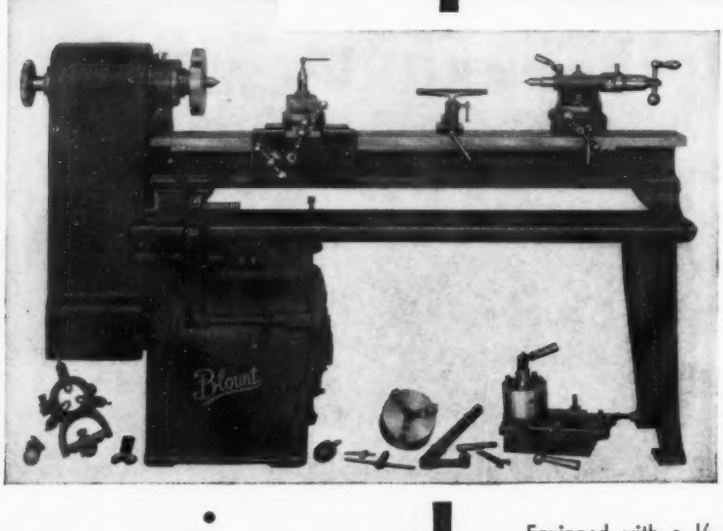
The Fitchburg "Type C" grinder is designed to meet war time production speed and maintain highest efficiency. Ease of operation is assured by centralized controls. In every detail it meets all the requirements of plain cylindrical and taper grinding — in large or small lots of work, with assured accuracy and fine finish, at low cost.

Send for new fully illustrated folder — write for it on your business letter-head — it will be mailed free.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of **— Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.**



"Blount"

MODEL B-4
SPECIAL PURPOSE LATHE

• • •

Meeting the need for a machine to handle a particular type of work . . .

•

Send for Bulletin D-18 giving detailed information on the complete Blount line of special application lathes.

•

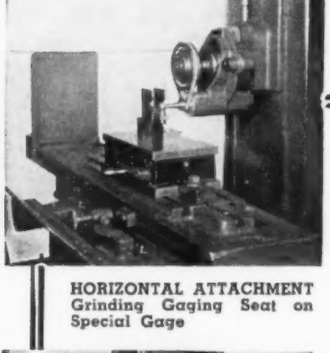
J. G. BLOUNT CO.
EVERETT, MASS.
U. S. A.

Equipped with a ½ HP. 4 speed ball-bearing headstock motor-in-leg, the Model 4B Blount Lathe provides speeds of 575, 850, 1125 and 1725 R.P.M.

This machine can also be furnished with reduction geared motor mounted on adjustable hinged motor bracket and belted to head. With this arrangement, spindle speeds of from 185 to 1356 R.P.M. are available. Other spindle speeds can also be furnished.

The standard machine has an 11" swing and an 6' bed length. Other bed lengths are optional.

Standard equipment includes a 4-speed drum controller, magnetic starter with pushbutton and fuseless disconnect switch. Spindle nose is 2⅜" dia. 10v threads per inch. Spindle is fitted with hand wheel draw-in mechanism to accommodate Rivet No. 6 collets, ⅛ to 1" capacities. Other equipment includes hand-feed carriage and compound rest, full set-over swivel tailstock, belt, belt guard and belt shifter. Various accessory equipment can be furnished.



HORIZONTAL ATTACHMENT
Grinding Gaging Seat on Special Gage

VERTICAL ATTACHMENT
Grinding Clearance of Broach Teeth

LIBERTY HI-SPEED GRINDING ATTACHMENTS SAVE TIME IN SET-UPS . . . *on precision jobs*

More and more shops are taking advantage of the accuracy and speed on a wide range of tool, die and gage work assured by these new Liberty Grinding Attachments.

Designed for quick, simplified set ups — on Brown & Sharpe, Reid and other surface grinders — these precision-built, easily adaptable attachments provide for the widest possible variety of applications.

Investigate Liberty Hi-Speed Grinding Attachments for saving time in grinding gages, angles, slots, recesses and surfaces which are impossible to get at with large wheel. See for yourself how you can eliminate difficult and long expensive set-ups in which small wheels are a necessity.

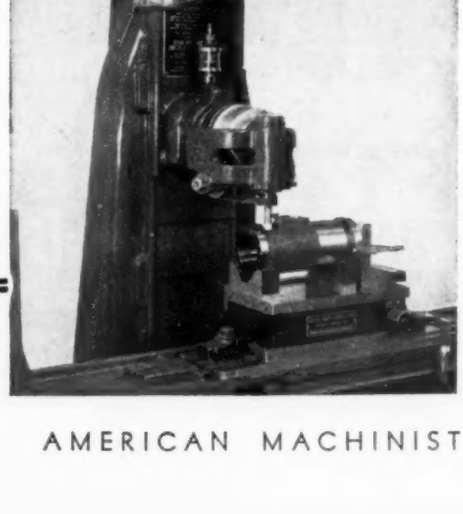
Available for horizontal or vertical spindles, these units can be shifted to numerous positions. Can be attached in a few minutes.

Assembled complete with any size bores, pulley belts and grinding wheels at no extra cost. Write for Descriptive Bulletin.

To facilitate shipment, kindly specify diameter of spindle head, type and make of grinder in ordering.

EQUIP YOUR GRINDERS NOW Prompt shipments on standard units can be made if orders are placed immediately.

VERTICAL ATTACHMENT
Grinding Rectangular Opening in Trigger Casing



LIBERTY TOOL & GAGE WORKS
PROVIDENCE • RHODE ISLAND

SHARPEN TOOLS correctly!

CORRECT SHARPENING IS THE FIRST ESSENTIAL FOR TOOL CONSERVATION AND HIGH PRODUCTION

- Bent or bowed arbors cause cutter runout, reducing the efficiency of the tool.
- Establish regular resharpening periods.
- Keep cutter close to the spindle.
- Use the smallest diameter cutter possible to do the job.
- Investigate machine conditions when breakage occurs.

Remember! There is economy in keeping tools properly sharpened. They will cut faster, last longer, use less power and produce more accurate work with superior finish than if used when in dull condition.

ILLINITE

High Speed Production Tools

Hobs · Broaches · Shaper Cutters
Milling Cutters
Ground Form Tools · Special Tools

★ ★ ★

Gear Measuring Machines
Gear Measuring Blocks
Die Filing Machines

ILLINOIS TOOL WORKS

CUTTING TOOLS AND SHAKEPROOF PRODUCTS

MANUFACTURERS OF METAL
2501 N. Keeler Avenue, Chicago, Illinois

In Canada: Canada Illinois Tools, Ltd., Toronto, Ont.

MODERN
SMALL TOOLS

STATIONARY SELF-OPENING DIE HEADS—

—ROTARY SELF-OPENING DIE HEADS—

—STATIONARY COLLAPSIBLE TAPS—

—ROTARY COLLAPSIBLE TAPS—

MODERN MAGIC CHUCKS AND COLLETS

—SELF-OPENING STUD SETTERS—

INSERTED BLADE FACE MILLING CUTTERS–

—SOLID ADJUSTABLE DIE HEADS—

ADJUSTABLE HOLLOW MILLING TOOLS—

UNIVERSAL CHASER GRINDING FIXTURES–

MANUFACTURED BY

MODERN TOOL WORKS

DIVISION OF CONSOLIDATED MACHINE TOOL CORPORATION

ROCHESTER **NEW YORK**

BROACHING ADVANCES CONTINUOUSLY

BROACHING, which has taken its place among machining methods as a process of great resource, is making continuous advances under the lash of war demand.

New methods of using broaching—new problems solved by it—greater speed—more economy—advances along these lines are of almost daily occurrence.

The Red Ring Double Jump Broach opens an entirely new field of operation, making notable savings in time and tool cost. Red Ring Broaching of multiple involute splines for universal joints and other machine elements permits high strength-weight ratio, and operation with minimum back-lash.

Naloy steel and improved design have provided broaches of amazing ability to stand long runs with a minimum number of regrindings.

When you consider machining methods, consider broaching—and—get the latest information on broaching.

National Broach and Machine Company has pioneered much of the high production broaching. We have accumulated engineering experience that will be valuable to you. We'll be glad to consult.

NATIONAL BROACH AND MACHINE CO.

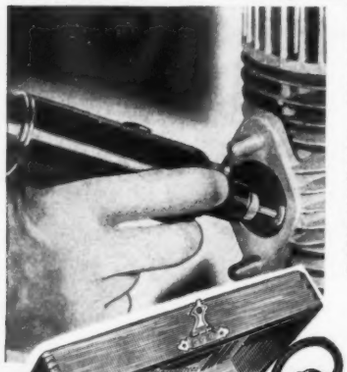
RED RING PRODUCTS

5600 ST. JEAN · DETROIT, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

MOTO-TOOLS SPEED UP WAR PRODUCTION



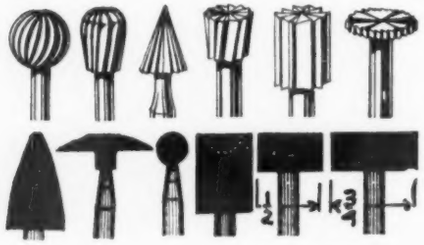
Dremel Moto-Tools are speeding up war production in defense plants from coast to coast. These rugged tools tackle grinding, routing, buffing and finishing jobs with speed and precision . . . faster and easier, especially in close quarters . . . in hard-to-get-at places.

A Dremel Moto-Tool has a shock-proof bakelite housing, oil-sealed bearings, and a balanced armature to eliminate vibration and produce finer finished surfaces. It weighs only 13 ounces . . . can be hooked up to any AC or DC outlet. Used in America's leading arsenals of democracy . . . by General Electric, Westinghouse, Remington Arms, Ford, Nash-Kelvinator, Consolidated Aircraft, Northrop Aircraft, and many others.

Below: Tool makers find Moto-Tools sensitive, finger-tip control indispensable when shaping intricate or irregular metal dies. For grinding or cutting with steel accessories . . . it can't be beat for convenience and adaptability.

Above: Moto-Tool is ideal for getting into close quarters, grinding, buffing and finishing to required specifications. Can be used for metal, wood, plastics, porcelain, glass, and other materials.

This complete Moto-Tool kit has accessories for all types of grinding, buffing and finishing operations . . . with steel cutting tools and the best abrasives. Consist of 1 Model 2 Moto-Tool with three collets:—1/8", 3/32", and 1/16", 4 Emery Wheel Points, 1 Dressing Stone, 8 Carving Cutters, 1 Steel Saw, 3 Bristle Brushes, 1 Steel Cleaning Brush, 1 Screw Mandrel with Sanding Discs, and 1 Shoulder Mandrel, one 1/2" Drum Sander. Packed complete in sturdy felt-lined hardwood cabinet case . . . $23.50. Dremel No. 2 Moto-Tool only . . . $16.50.



Dremel emery wheel points, steel cutters and accessories with 1/8" shanks are available for quick delivery in a wide variety of sizes and shapes. They can be used with practically all makes of hand grinding tools. Write for catalog.

10-DAY TRIAL

Try a Dremel Moto-Tool for 10 days in your own shop. See how versatile, how indispensable it can become to fast, accurate work. Order from your industrial distributor, or contact any of the following representatives:

WEST COAST
The Federated Sales Co.
2437 West Valley Blvd.
Alhambra, Calif.

METROPOLITAN NEW YORK
Mill Factor Products Co.
53 West Broadway
New York, N. Y.

PACIFIC NORTHWEST
Mac S. Sprincin
2407 First Ave.
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NEW ENGLAND
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DREMEL MFG. CO., Dept. T-472-R, Racine, Wis.

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and use them in practical jobs

All the math you need in the trades, machine shop, drafting room, and other practical and technical jobs made plain in this ONE handy volume

This complete study and practice course presents the kind of mathematics needed by the man who wants something that he can apply to the every-day problems of his job. It brings him a clear, simple, and usable knowledge of the essentials of the subject—a step-by-step treatment of mathematics without needlessly involved explanations and methods.

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PRACTICAL MATHEMATICS FOR HOME STUDY

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THIS book explains the many practical uses to which mathematics can be put, and shows the reader by example, just how he can apply it to the problems which he encounters in his daily work. For 23 years the first two editions have been used in schools and by men studying or brushing up on mathematics at home. In this edition, the same simple, easy-to-understand treatment of mathematics that made the book so popular is brought to you, but with applications and problems expanded and brought abreast of new technical practices.

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The Palmer course grew out of many years of experience. Men working in shop, factory and engineering office—who were faced constantly by problems that could only be solved successfully with mathematics—brought their problems to Dean Palmer. He in turn helped them find the solutions. On these practical "experience meetings" the course was built.

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ARMSTRONG Machine Shop Specialties
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—all vital tools of modern warfare.

Your Tools Are Fighting A WAR!

★

CUTTING TOOLS are up in the front line in the Battle of Production—and it's no place for weaklings or slackers! To cut efficiently on all sorts of war production jobs, to reduce idle machine time, to avoid costly breakage, your tools must be kept in perfect cutting condition, reconditioned with mathematical accuracy.

Oliver Tool Conditioners will do this job! The Oliver ARC Face Mill Grinder, for instance, can be set up to sharpen any cutter from 6″ to 26″ in diameter, any radius from 0″ to 2″, any angle from 0 to 90 degrees, any agle of "dish," plus or minus. The No. 2-A machine (not illustrated) will do similar work on end mills, shell end mills and similar work from 1″ to 6″ in diameter. In producing *a round corner* between the face and the periphery of the mill, the Oliver ARC grinds the entire surface of each tooth in one continuous movement of the wheel, blending the corner exactly into the cutting edges and reducing by *two-thirds* the number of indexings necessary

Keep your face mills and other cutting tools cutting like new—and do this important job of tool conditioning in less time! Write for bulletins showing how Oliver Tool Conditioners can be used to keep every tool in your plant cutting with wartime efficiency.

Don't Neglect Your Toolroom It's the Backbone of Production!

OLIVER INSTRUMENT CO.
1414 E. Maumee St. Adrian, Mich.

Oliver OF ADRIAN

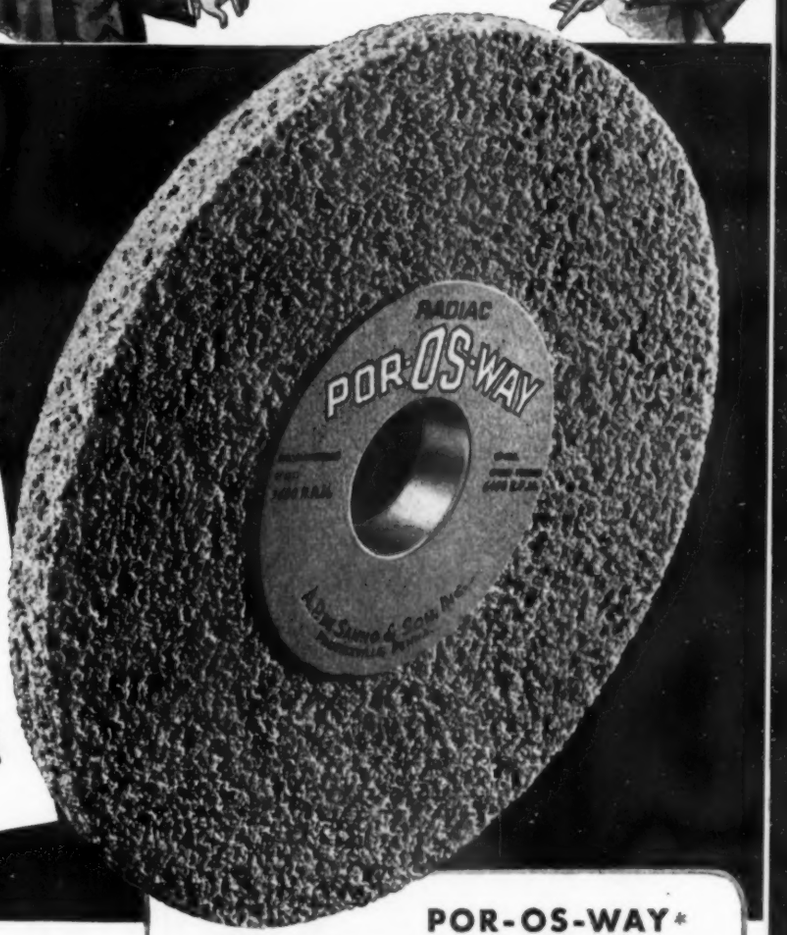
AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

"TRIAL-TEST" POR-OS-WAY

the new, precision grinding wheel!

IT DELIVERS

2 TO 5 TIMES MORE PRODUCTION PER MAN PER MACHINE



LET USERS TELL THE STORY—

FASTER AND COOLER—"Cut so much faster and cooler than other wheels that several department heads were called in to witness the operation." (Surface grinding small discs.)

300% BETTER PRODUCTION—"Gave 300% better production than competitor wheel. Held a true edge in grinding a complete gear cutter with no burn whatsoever. Free, cool cutting without dressing. Good finish." (Grinding high-speed cutter tool steel on Le Blond grinder at 4750 R.P.M.)

SUCH EXCELLENT RESULTS—"As head of department, would like to change over all grinding to Por-os-way wheels as I have had such excellent results."

350% BETTER PRODUCTION—"Very successful; gave 350% better production." (Grinding Stellite "J" cutter heads on Cincinnati No. 2 tool and cutter grinder at 5735 R.P.M.)

OUTSTANDING GRINDING QUALITIES—"Outstanding grinding qualities. Wheel wore but ¼" on 50 pcs. ground. Edge held up." (Grinding shafts in gauges at 3200 R.P.M., removing .005" stock.)

NO LOADING, NO BURN—"Cut freely, did not load and cut hardest steel without any trace of burn. Obtained at least 300% better production." (Facing tool steel gears SAE 41-50 at 3460 R.P.M.)

HELD EDGE WITHOUT DRESSING—"Gave 50% better production than competitor. Held edge without dressing. Ground 4942 pcs.—average 353 pcs. per hour." (Grinding hardened steel bushings on B & S.)

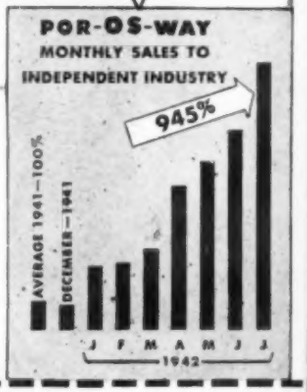
25% INCREASE IN WHEEL LIFE—"Enclosed find order for Por-os-way. Trials very satisfactory. Reduction of 40% grinding time. 25% increase in wheel life".

POR-OS-WAY* 8 WAYS BETTER

1. 2 to 5 times faster stock removal. Takes deeper cuts, or usual cuts at faster feeds.
2. Holds its corners. Requires only minimum dressing.
3. Does its job at the lowest possible cost.
4. Equal or better wheel life.
5. Cool action structure.
6. Practically ends burning.
7. One man, one machine can do the work of 2 to 5.
8. Free cutting. Resists "loading" of soft materials.

See the trend to Por-os-way—introduced formally in Fortune Magazine, February, 1942.

*T. M. Reg. U. S. Pat. Off.



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Mail the coupon yourself or clip ad, check below and route to responsible person.

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CERTAINLY— I WANT 2 TO 5 TIMES MORE PRODUCTION PER MAN PER MACHINE. Send along that Por-os-way folder with its "Prescription Blank" for a demonstration of Por-os-way's 8 advantages.

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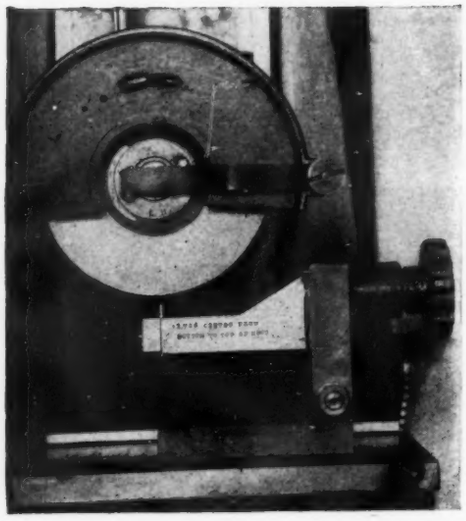
The Western Gateway to Valley Forge



Simplify Grinding Radii and save Valuable Time • • • •

with the NEW C-66 RADIUS DRESSER

1—Faster, more accurate dressing

2—Ability to dress for radii where clearance angle on radius is involved

3—No necessity to remove wheel guard

4—Open and easy to see dressing operation

5—Ability to rotate 180° or 90° in either direction, with stop pins

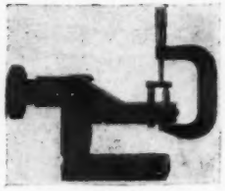
6—Simple setting of diamond

7—Ability to use several sizes of diamonds and hold them accurately in ground vee

8—Safety feature, hands are kept away from under the wheel

Price $72.50 without diamond, $5.00 extra with diamond

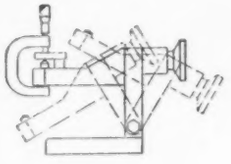
Diamond is set by measuring with micrometer from top of hood to bottom of arm.



Vee Ground in Center of Arm

.013 Male and Female Radius

.500 Male and Female Radius



Radius Dresser can be set at clearance angles for turning tools.

SCHULTZ & ANDERSON CO., 109 EDISON PLACE, NEWARK, N. J.

In These Days of SCARCITY . . .

KNIVES MUST LAST LONGER

TYPE CC-3
ROGERS CIRCULAR
KNIFE GRINDER

Rogers Grinders Conserve Knives

Sharpen your own knives and be independent of delays, higher costs and *unnecessary wear!* Finely adjusted automatic control assures *keen cutting edges* . . . with *minimum removal of metal.* No skilled operator required.

Reasonable shipments to high priority holders . . . subject to our obligations to war production industries. Also manufacturers of circular knife and band saw sharpening equipment.

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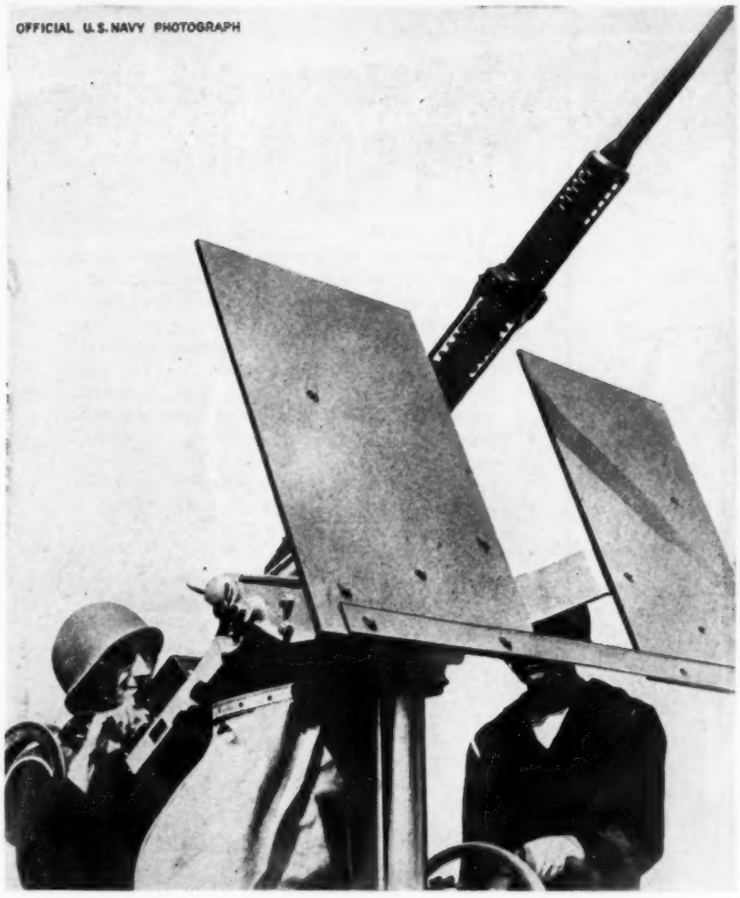
Veneer
or Any Straight Knife
on Edge or Face

ROGERS "NT" KNIFE GRINDER

PRECISION QUALITY **ROGERS KNIFE GRINDERS** **SINCE 1887**



GRAND RAPIDS

THE SURFACE GRINDER FOR FASTER OUTPUT IS THE MACHINE FOR MAKING GUNS . . . . .

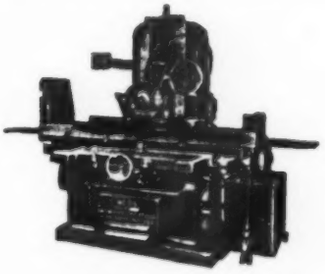
Grand Rapids Grinders are doing their bit in the manufacture of the famous Oerlikon gun, by grinding trigger housings to close limits at a high production rate.

Grand Rapids machines earned their stripes more than 20 years ago through their ability to produce work to the highest degrees of accuracy in long hard service. Their ability to speed the output of commercial products and their versatility are again being demonstrated in precision armament manufacture. And what Grand Rapids Grinders have done in peace time work they will do again because they are universal production speeders ready for any job that comes within the scope of their broad utility.

With sizes and types available for a wide range of requirements, Grand Rapids Grinders can solve both tool room and production problems.

Our engineers are ready to apply their experience to your needs.

GRAND RAPIDS HIGH SPEED NO. 55 HYDRAULIC FEED SURFACE GRINDER

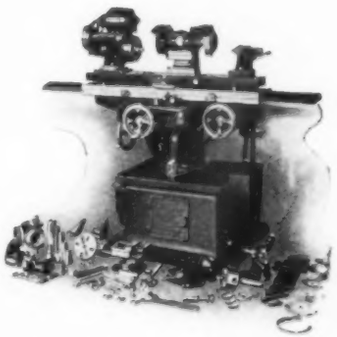


This modern, precision machine, for tool room or production, has a table working surface of 12"x36". Automatic table travel is 38"; transverse travel is 13½".

Furnished with infinitely variable table speeds, vernier vertical wheel adjustment and rigid, one-piece column and base as well as with hydraulic feed, this Grand Rapids machine can be depended on for the maximum in convenience of handling and smoothness in operations.

For detailed information ask for Bulletin GL100.

GRAND RAPIDS TOOL AND CUTTER GRINDERS NOS. 4 AND 5



These Grand Rapids machines can be depended on to assure perfect tool sharpening and thereby contribute to faster production and longer tool life. Operation from front or rear facilitates handling.

Ability to perform internal, surface or tool grinding quickly, accurately and conveniently makes these Grand Rapids machines ideal for sharpening such tools as gear cutters, formed cutters, angle cutters, face mills, end mills, side mills, spiral and plain milling cutters, thread chasing tools, reamers, hobs, etc. Ask for Bulletin 3-1-41 giving full details.

GALLMEYER & LIVINGSTON CO.
330 STRAIGHT AVE.
GRAND RAPIDS, MICH.

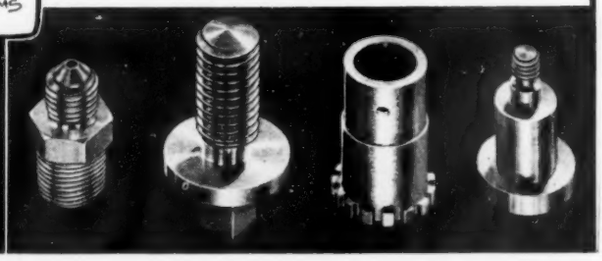
OUT OUR WAY
BY J. R. WILLIAMS
I HEAR THEY REJECTED THE OLD BULL IN THE LAST WAR ON ACCOUNT OF FLAT FEET!
YEH, BUT THAT DON'T CUT ANY ICE AROUND HERE -- THE OLD BULL HAS TO MARCH ALL DAY WITH A FULL PACK ON HIS MIND AND NO JEEPS TO CARRY HIM!
THE REAR RANK GENERAL
J.R.WILLIAMS

Our Hat's Off to the 'Old Bull'...

VICTORIES don't come easy. Each and every one of us must *better his best* if we are to reap the rewards of a sound and victorious peace. We have also another obligation... to think and plan ahead wherever we can to meet the economic and production problems that will arise when this war is won. The time for this post-war planning is *now*. Anything we can do *now* to make the changeover to peacetime production smoother and less costly should and must be done. Let's tackle this problem together...and together do our share to assure the economic stability of this country after victory.

(*Below*) A few of the many thousands of our precision-made parts that help "Keep 'em flying and fighting."

ERICSSON ESTABLISHED 1911



ERICSSON

SCREW MACHINE PRODUCTS CO., INC.

25 LAFAYETTE STREET, BROOKLYN, N. Y.

PRECISION • STRENGTH

Today's demands for precision and strength only emphasize the fact that Mac-its always have been made as accurate and strong as possible.

The Mac-it process plus perpetual testing and skilled heat treatment produces screws that meet the strict specifications of Victory tools and weapons.

Whenever your production calls for utmost Precision and Strength in holding-together or holding-down jobs . . .

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THE STRONG, CARLISLE & HAMMOND COMPANY

1392 West Third St., Cleveland · Ohio

Speed Production on many small flat surface jobs

with this NEW *Sliding-Table*

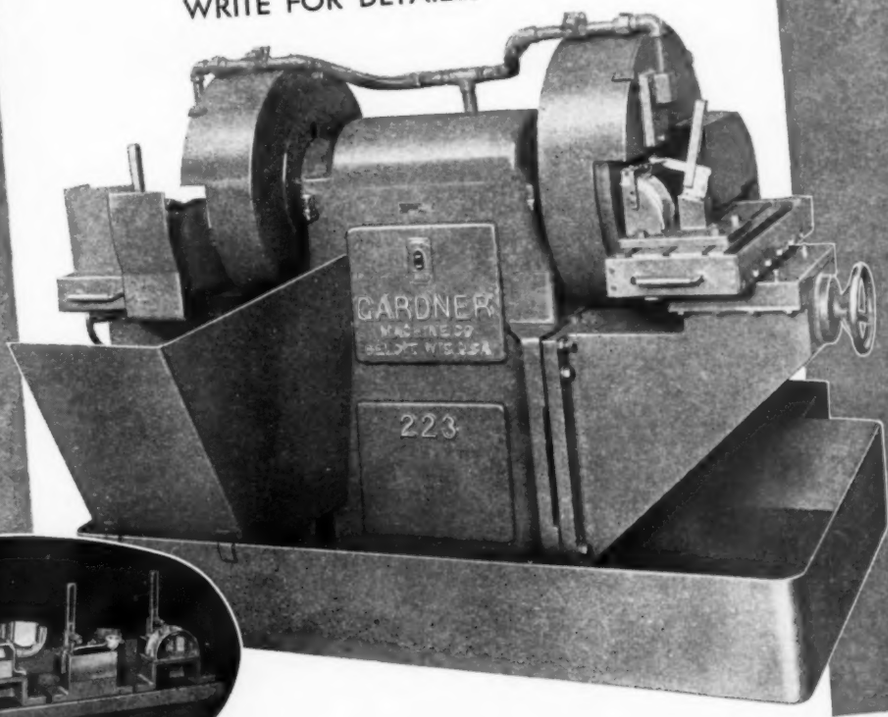
GARDNER GRINDER!

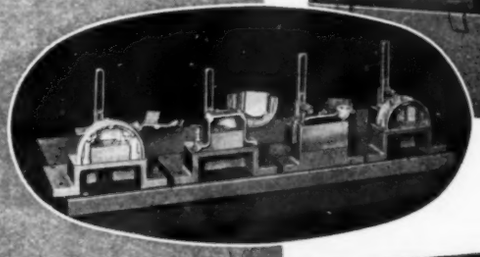
EASE of operation is the feature of this sturdy No. 223-23" Gardner Grinder, which carries 2 Hand-Operated Sliding Work Tables.

Each table is mounted on ball bearing ways, so that it slides at the slightest touch. On light work, this ease of operation stimulates production, and often produces a better grind than does the standard swinging lever-table. For example, on some thin parts like the die cast radio shields shown here, a straight cut across the wheel with this sliding table, eliminates distortion which a radius-cut might generate.

Check the adaptability of this NEW TOOL to YOUR flat surface jobs.

WRITE FOR DETAILS!





GARDNER MACHINE COMPANY

410 East Gardner Street » » » Beloit, Wisconsin, U. S. A.

Carbon and slag, clinging to cutting tip orifices, are pseudo fifth columnists — they waste oxygen and acetylene, they slow production, they impair quality of cuts. Such tips nullify the value of using proper gas pressures and cutting speeds.

Be sure your men keep every active tip clean. Keep cleaning drills handy, see that they are used often. In this way you can help get the most out of every cubic foot of oxygen. Let's each one of us be his own Waste Warden. By so doing we can speed final victory.

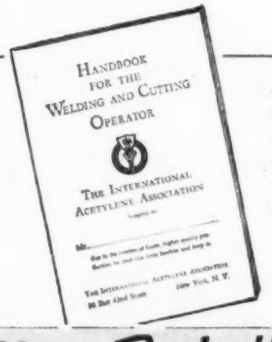
THE WASTE WARDEN

says:

DO close cylinder valve after use.
DO check your hose and connections for leaks.
DO keep your cylinder inventory low and return empties promptly.

* * *

DON'T use excessive pressures or oversize tips.
DON'T leave torch burning when not in use.
DON'T abuse cylinders.



Copies of helpful booklet — telling how to maintain maximum production — now available. Write Airco for your copy.

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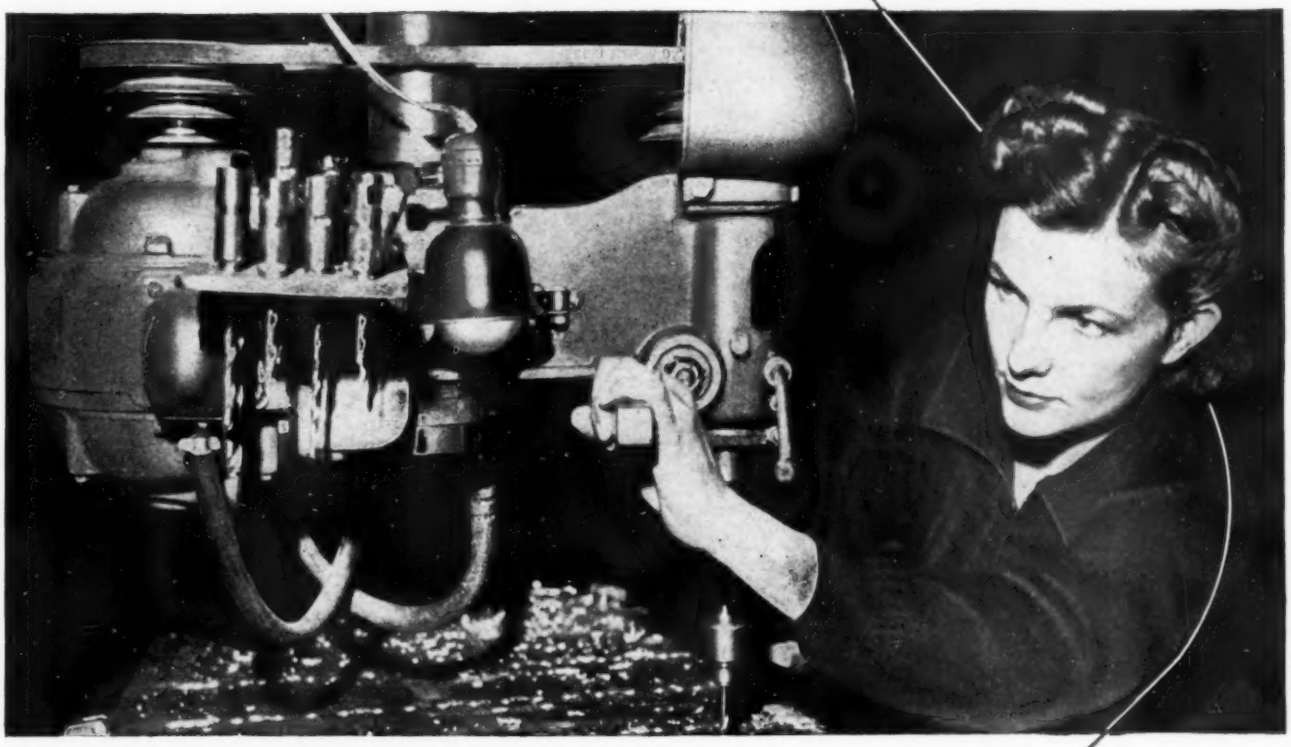
AIRCO

WILSON

OXYGEN IS PRODUCTION — *Don't Waste it!*

LIKE A DUCK TO WATER

WOMEN and unskilled operators take to these machines



AND here's the proof: Reports from shop superintendents and managers in plants (*names on request*) using Delta Drill Presses, Grinders, Saws and Cut-Off Machines read: ". . . unskilled operators can be used successfully due to the accuracy and perfect balance of Delta machines." ". . . with standard Delta Drill Presses we have built a special machine that enables us to use unskilled labor on an extremely difficult operation—thus freeing skilled mechanics for more difficult work." ". . . the training time and breaking in period have been considerably reduced with Delta machines—thus permitting us to take better advantage of unskilled labor." ". . . they are safer to operate, are more accurate and are built with precision balance, so we can use unskilled operators on most jobs . . ."

DELTA DESIGN
Always Offers These Advantages

Low First Cost
Low Maintenance Cost
Economical Operation
Reduced Labor Costs
Greater Flexibility
Portability

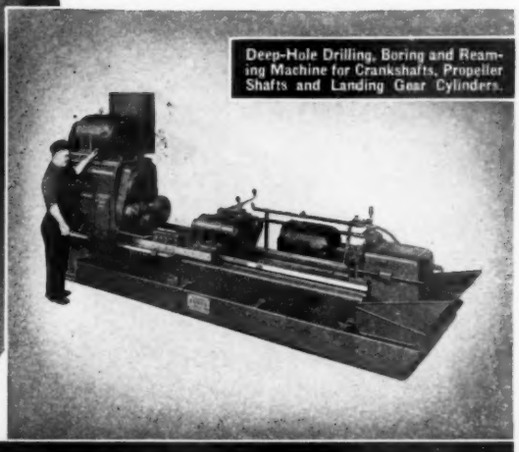
The complete DELTA-Milwaukee line consists of low-cost, high-quality Drill Presses, Cut-Off Machines, Grinders, Abrasive Finishing Machines, Saws, Lathes, Jointers and Shapers.

SEND FOR FREE "TOOLING TIPS" Write for this practical shop bulletin showing how other manufacturers are taking advantage of the many features of DELTA-Milwaukee machines. Get in touch with your nearest Delta Industrial Distributor or write direct to The Delta Mfg. Co., 608-L E. Vienna Ave., Milwaukee, Wis.

DELTA
MILWAUKEE

In The Heart Of America

Your requirements may affect machine design. We can assist in determining and building the machine best suited to your needs.

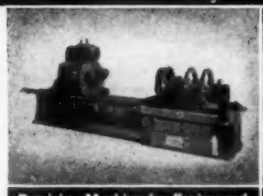


Deep-Hole Drilling, Boring and Reaming Machine for Crankshafts, Propeller Shafts and Landing Gear Cylinders.

WE ARE BUILDING PRODUCTION MACHINE TOOLS
For the Aircraft Industry

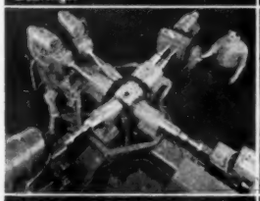
● To the Aircraft Industry, whose products are so vital to a complete victory by the Allied Nations, we offer a line of machine tools for aircraft manufacture. Whether your requirements are for strut boring and honing, drilling and boring crankshaft lightening holes, crankcase or cylinder drilling or boring, boring of cam and crankshaft bearings, accessory housing drilling and boring, or special machining operations, W. F. and John Barnes Company can furnish machines for the job.

Write today — for further information or send us your part prints with specifications and we will be pleased to quote you on a machine to fulfill your requirements.

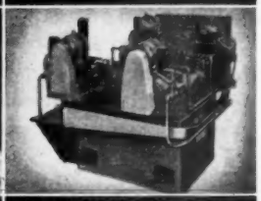


Precision Machine for Boring and Facing Main and Accessory Shaft Bearings.

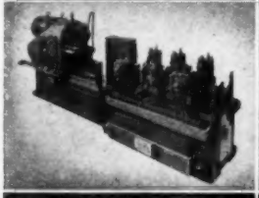
Cylinder Head Drilling and Forming Machine.



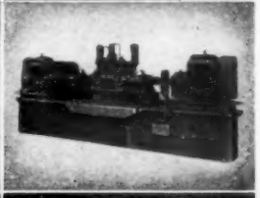
Unit-Type Precision Boring and Facing Machine.



Special Machine for Tapping Engine Mounting Pads.



Crankshaft Drilling, Boring and Chamfering Machine.



Double End Crankshaft Recentering Machine.

FOR EXCELLENCE... W. F. and John Barnes Company takes pride in announcing the privilege of flying the "E" flag.

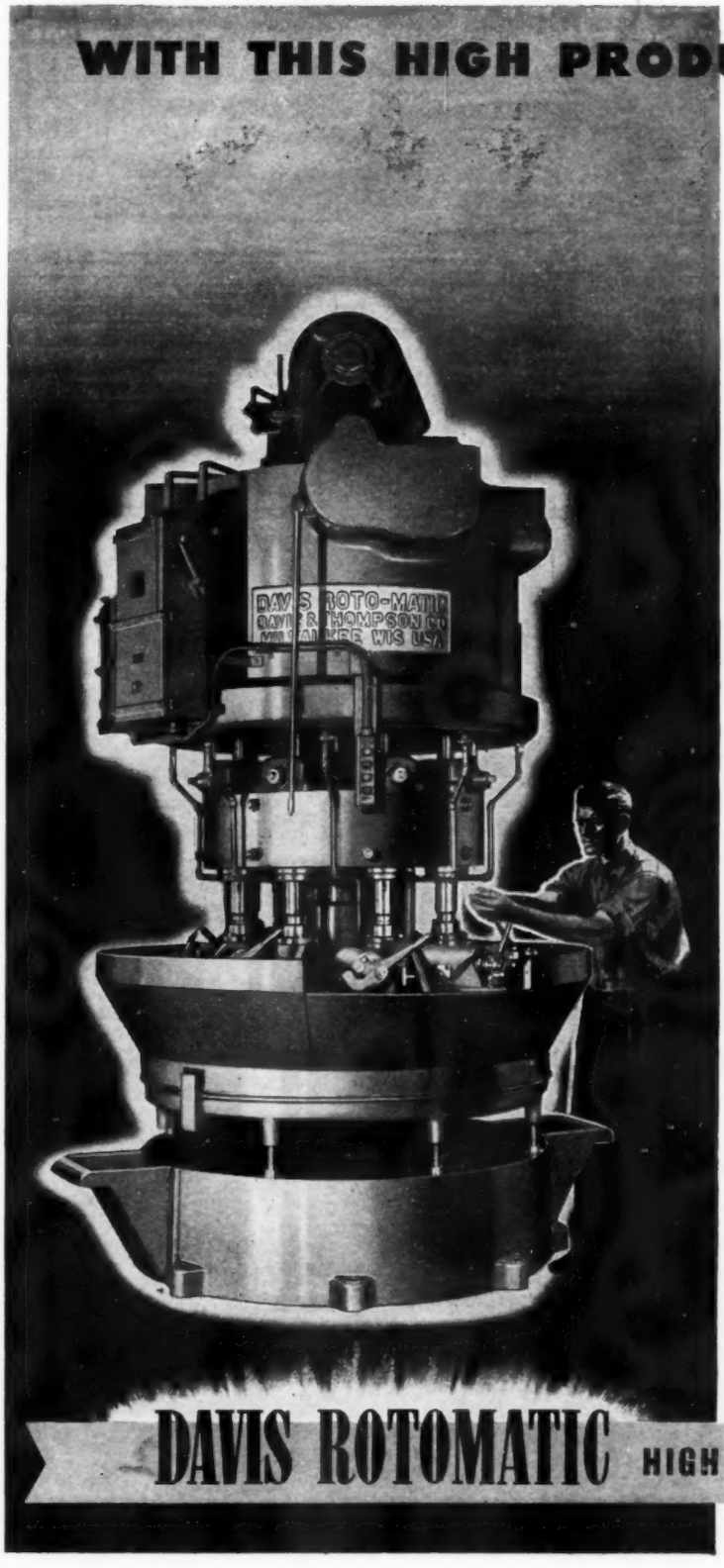
W. F. & JOHN BARNES

W. F. and JOHN BARNES

310 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

Every Minute Counts -

WITH THIS HIGH PRODUCTION MACHINE



The ammunition and mechanized weapons of modern war now rolling off American production lines in a mighty stream are made possible by high production machine tools like this Davis & Thompson Multiple Spindle Continuous Vertical Drilling Machine and Heavy Duty Miller.

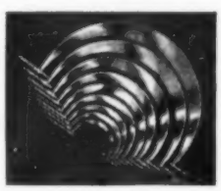
Every minute of the hour counts with this machine — for every hour several hundred detonating fuse points for bombs — are milled by special cutters on this multiple spindle, specially designed and built Davis & Thompson high production machine. Anyone familiar with machining operations will recognize this to be remarkable production performance.

The Davis & Thompson Company specializes in the development, design and construction of high production, metal working machines of which the above is typical. Hundreds of them are in use — machining airplane engine parts, shell and bomb fuses, machine gun barrels, tank track links and scores of other units and parts in war production.

Leading American firms have long depended upon Davis & Thompson—in peace as well as war — for high production machines built with precision and stamina to work day in and day out at top speed, month after month, and year after year.

DAVIS & THOMPSON COMPANY
MILWAUKEE, WISCONSIN, U. S. A.

D & T
Tubular Micrometers
AND STANDARDS
make it easy to be sure of accuracy to the thousandths of an inch on large diameters and bulky, unwieldy parts. Available in 45 different sizes — capacities ranging from 0 to 168 inches.



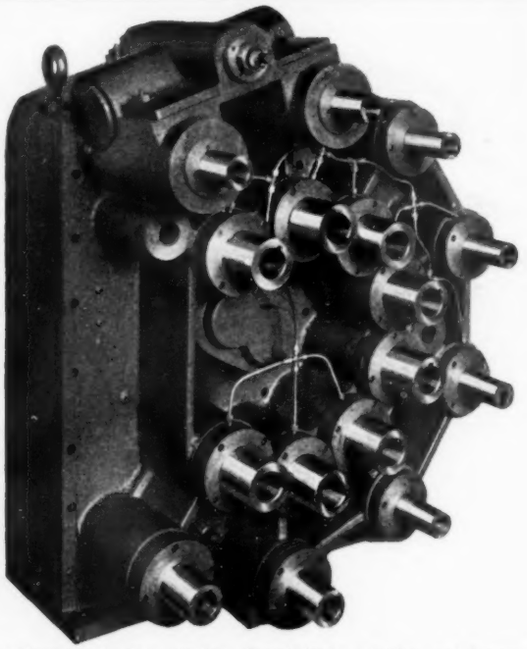
DAVIS ROTOMATIC HIGH PRODUCTION MACHINERY

Buhr

DRILL HEADS SIMILAR TO THIS ONE,

ARE SPEEDING PRODUCTION IN VITAL WAR PLANTS

Here is but one example of the specialized engineering incorporated in BUHR-designed drill heads, now being used in the production of aircraft and armament. Want similar applications, so as to speed your work? Then send us your blueprints . . . . we'll make suggestions and recommendations on the use of BUHR-engineering and equipment.

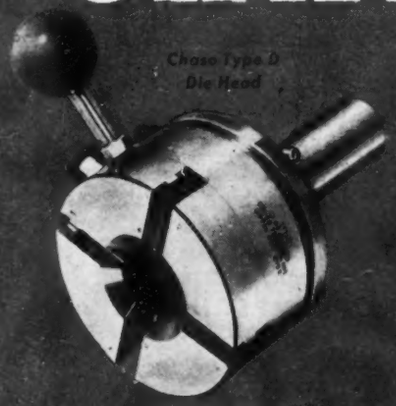


Sixteen-spindle Buhr Drilling, Counterboring, Facing and Reaming Head, designed for the left-hand head of a 2-way Machine. Vertical adjustment. Two top spindles are accelerated to give three times the feed of the other spindles. Oil pump provides positive lubrication.

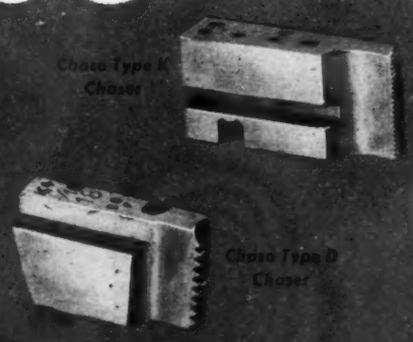
BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICH.

Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment

CHASO Threading Tools

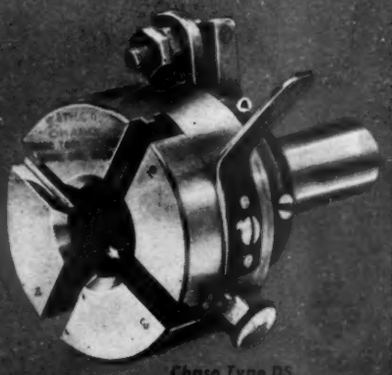


Chaso Type D Die Head



Chaso Type K Chaser

Chaso Type D Chaser



Chaso Type DS Die Head

IT'S *Chaso* FOR CHASERS!

We make chasers for most of the well-known makes of self-opening die-heads.

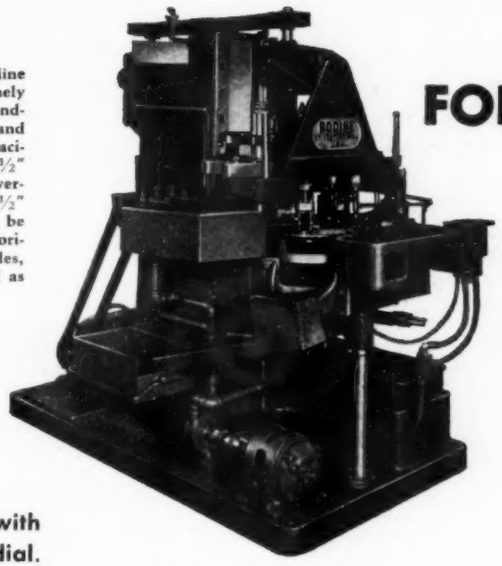
● CHASO CHASERS must prove satisfactory in order to fulfill the CHASO guarantee for quality, workmanship and accuracy. It means also that users of CHASO THREADING TOOLS *must* obtain better service in terms of more threads of closer accuracy between grinds.

● CHASO production methods assure the satisfactory performance of CHASO CHASERS AND DIE HEADS. Write for our catalog.

CHASO TOOL COMPANY, Inc. ***Royal Oak, Michigan***

Bodine GANGS PRODUCTION TOOLS FOR Speed

Six standard sizes of Bodine machines cover an extremely wide range of needs in handling ordnance components and other parts . . . with capacities ranging from ¼" to ½" taps and drills and with vertical stroke from ⅛" to 3½" maximum. Machines may be equipped with vertical, horizontal or angular spindles, also spindles below as well as above the dial.



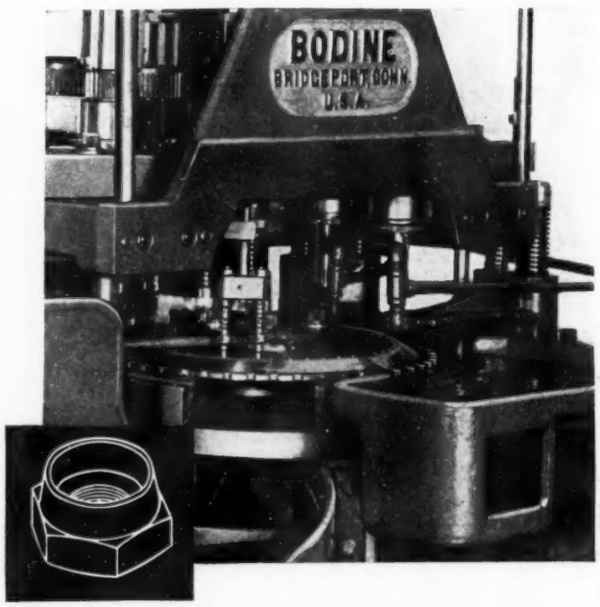
Bodine No. 48-20 with 18" dia. indexing dial.

The Bodine basic principle of design, of great advantage in peace-time, is doubly important now in saving precious hours on war production schedules.

By combining a series of drilling, milling, tapping and screw inserting operations in *one* machine . . . and providing for extreme flexibility in the locating of multiple spindles around an indexing dial . . . one operator directs simultaneous or sequence machining with a single tooling set-up. Work is manually or automatically fed into position on the dial, the operations being performed as parts progress from station to station. In many cases ejection is also automatic. Electrical interlocks protect machine and tools, assure safety of the operator.

Ganging of tools plus speed of operation, produce finished parts at a high rate per hour. Bodine design and precision construction permit production to extremely close tolerances.

War plants with one or a battery of Bodines are stepping up production easily and quickly on ordnance and other components. Ask Bodine for details. Send your blueprints or sample parts for engineering recommendation.



TYPICAL TOOLING FOR No. 48-20

Close-up shows the Bodine 48-20 Machine with tooling set-up and dial arrangement for drilling and tapping a special nut. Four drilling and two tapping spindles are used to produce two pieces per stroke of the machine, three operations on each piece. Feeding is by hand and ejections automatic. Speed is dependent upon material used, which may be aluminum, brass or any of the hi-alloy steel and stainless steel materials.

THE Bodine CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

WINTER
Quality
TAPS

. . . for

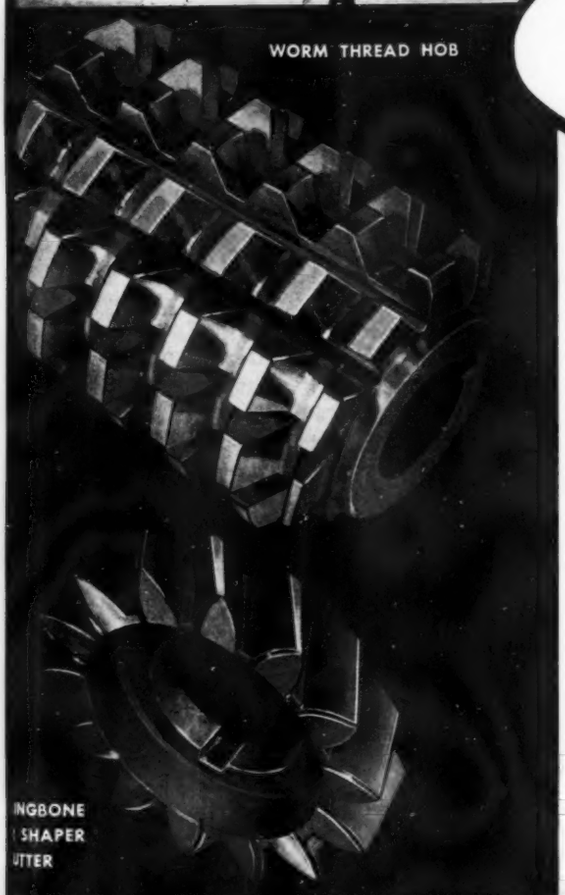
AIRCRAFT PRODUCTION

To produce all the tapped holes required for a gigantic United Nations Air Fleet requires an enormous production of top-quality Taps of all types and sizes. Concentrating on high-production; recognizing only one top-quality grade of an accuracy and uniformity above criticism; Winter Brothers are particularly well equipped to produce Quality Taps in substantial volume. When you specify WINTER BROTHERS TAPS . . . you'll receive top-quality tools just as quickly as it is humanly possible to deliver them!

Winter Brothers
COMPANY
Wrentham, Massachusetts, U. S. A.
Branch Factory, Detroit, Michigan

A Division of
THE NATIONAL TWIST
DRILL & TOOL CO.
Detroit, Mich.

on the target



"On The Target" is the fulfillment of many hours of careful planning and intensive training. The preliminary work is over—the moment for action has arrived. National Cleveland Tools are today "On The Target" in the war plants of America, producing vital parts for all branches of our armed forces, correctly designed and engineered for the specific job they are doing.

NATIONAL Tools CLEVELAND

THE NATIONAL TOOL COMPANY

11200 Madison Avenue, Cleveland, Ohio

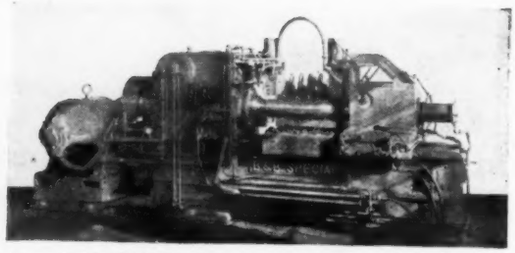
OBS • GEAR SHAPER CUTTERS • GEAR CUTTERS • MILLING CUTTERS
CIRCULAR AND FLAT FORM TOOLS • REAMERS • BROACHES
COUNTERBORES • SLITTING SAWS • SPECIAL TOOLS

KENNAMETAL
Accepted PARTNER TO
THE MODERN MACHINE TOOL

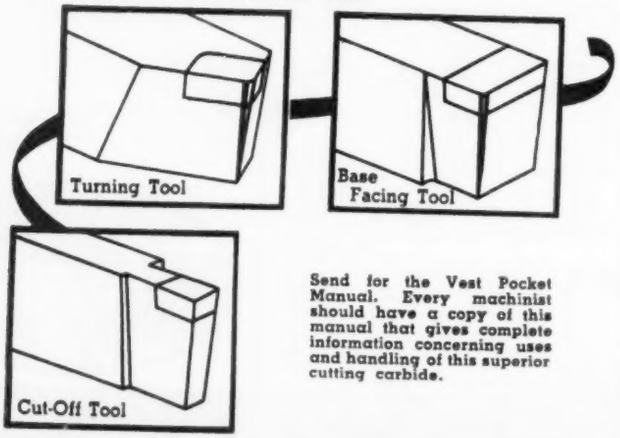
Modern lathes, turret lathes, boring mills, and other machine tools are powered to permit production undreamed of twenty years ago.

The output of these modern machines, however, is strictly limited by the cutting tools which do the actual work of removing the metal from rough forgings, steel castings, and bar stock. That is why so many modern machine tools are now equipped with KENNAMETAL-tipped tools. The high speeds and substantial feeds of which KENNAMETAL tools are capable permit full utilization of the productive capacity of these valuable machines.

It will be worth your while to investigate KENNAMETAL, the accepted steel-cutting carbide. Write today for our new Catalog No. 43 listing standard styles and prices of KENNAMETAL steel-cutting tools and blanks.



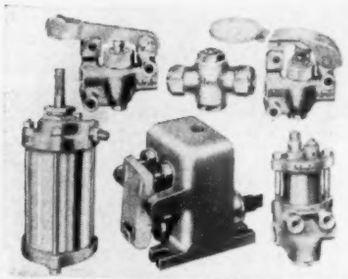
A special 75 H.P. Rough Turning Lathe for 155 mm. shell equipped with: (1) Six Tool Carriage, using KENNAMETAL Tools for Turning in one pass to contour at 320 ft. per min. and .020" to .030" feed, with ⅜" depth of cut, (2) Vertical Tool Slides for base facing and cutting off with KENNAMETAL Tools at .007" feed.



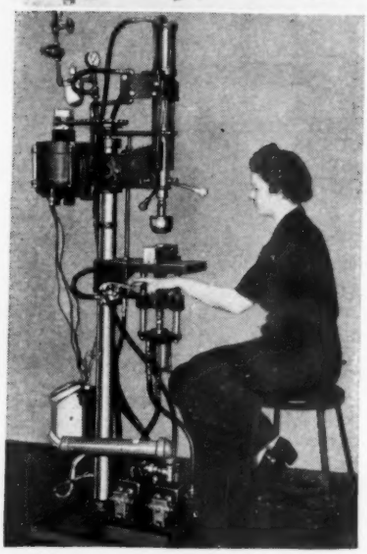
Send for the Vest Pocket Manual. Every machinist should have a copy of this manual that gives complete information concerning uses and handling of this superior cutting carbide.

McKENNA METALS Co.
103 LLOYD AVE., LATROBE, PA.

THESE SCHRADER AIR DEVICES



ASSEMBLED ON THIS MACHINE



INCREASED PRODUCTION 100%

In its original form, the above drill press performed the one operation of assembling two threaded parts. A second staking operation required another machine and operator. Now the machine is air-powered and performs both assembly and staking in one continuous cycle. After inserting the work, the operator merely touches the operating valve and both jobs are done automatically. This special hook-up uses standard Schrader 4-way valves, air cylinders, operating valves, hose and fittings. Results . . . production increased 100%, fatigue reduced, and the second machine and worker freed for other jobs.

ASSEMBLE YOUR OWN SPECIAL CONTROLS

The above case is typical of the controls that any production engineer can assemble with the Schrader Air Control units shown in Catalog No. 10. Send for a copy and see what you can do in your plant.

Schrader
REG U.S. PAT. OFF.
AIR CONTROL PRODUCTS

A. SCHRADER'S SON BROOKLYN, N. Y.
Division of Scovill Manufacturing Company, Incorporated

Courtesy Vultee Aircraft, Inc.

Easy for Women

TO PRODUCE EFFICIENTLY ON KENT-OWENS MACHINES

● At the Vultee Aircraft plant, women are proving adept operators of Kent-Owens Milling Machines.

Thus, aircraft builders are pointing the way to one solution for the critical shortage of skilled help in war plants.

Experienced shop men have long demanded Kent-Owens Milling Machines for their outstanding simplicity, ruggedness, dependability . . . features that appeal to *practical* men. These factors become increasingly important as more and more green hands are called upon to man America's war production machines.

Kent-Owens Machine Company, Toledo, Ohio.

THERE'S A KENT-OWENS REPRESENTATIVE NEAR YOU

BOSTON
General Machinery Corp.
BUFFALO
Don W. Patterson
CHICAGO
Neff, Kohlbusch & Bissell
DALLAS
Hamilton-Huster Machinery Co.
DAYTON
Gosiger Machinery Co.
DETROIT
A. C. Haberkorn Machinery Co.
GRAND RAPIDS
Joseph Monahan
HOUSTON
Oliver H. Van Horn Co., Inc.
INDIANAPOLIS
Oatis-Booth Machinery Co.
KANSAS CITY
Eichman Machinery Co.
LOS ANGELES
Eccles & Davies Machinery Company
Harron, Richard, & McCone
MILWAUKEE
Neff, Kohlbusch & Bissell
MOLINE
John J. Normoyle Co.
MONTREAL
F. F. Barber Machinery Co.
NEW ORLEANS
Oliver H. Van Horn Co., Inc.
NEW YORK
Wilson Brown Company
PHILADELPHIA
Calco Machinery Company
PITTSBURGH
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TORONTO
F. F. Barber Machinery Co.
WALKERVILLE
F. F. Barber Machinery Co.

Call on KENT-OWENS *for Milling Machines*

FOR VICTORY TODAY
AND SOUND BUSINESS TOMORROW

Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Payroll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save With

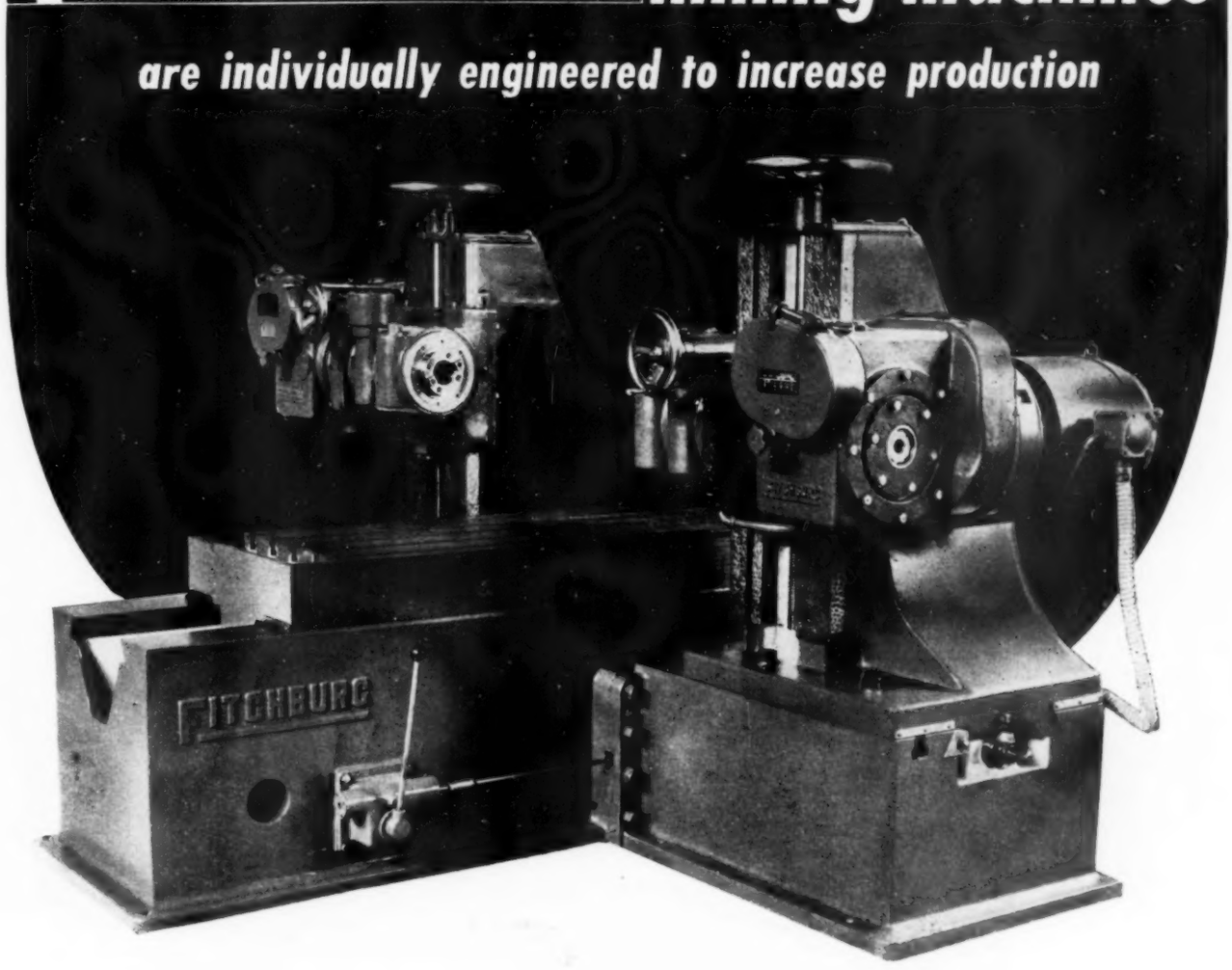
War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

AMERICAN MACHINIST

FITCHBURG milling machines

are individually engineered to increase production



• SPECIFICATIONS •

Length of table over working surface—60"
Width of table over working surface—24"
Feed and Traverse—60"
Distance between spindle noses: 18" minimum; 40" maximum
Center of spindle to top of table: 4" minimum; 22" maximum
Spindle speeds variable by pick off gears
Table Feed variable by hydraulic feed
Horizontal adjustment to each upright by hand—8"
Vertical adjustment of milling heads by hand—18"
Horizontal fine quill adjustment by hand—4".

★

Fitchburg engineers are at your service to help you speed up your production milling operations.

As specialists in high production milling, Fitchburg is in position to apply long successful experience to the design and development of machines to meet specific requirements in turning out more parts in less time.

Such a machine is shown here—an Adjustable Duplex Milling Machine. An outstanding feature is the ability to move the uprights of the machine thereby increasing its capacity.

FITCHBURG ENGINEERING CORPORATION

FITCHBURG, MASSACHUSETTS

early delivery

MOREY 8" VERTICAL SHAPER

EQUALLY EFFICIENT IN YOUR TOOL ROOM OR MANUFACTURING DEPARTMENT

features

Precision . . . Easily handled—your operators will appreciate it . . . **Cutting Stroke** changed quickly . . . **Feeds** varied instantly . . . **Power** rapid traverse in all directions . . . **Brake** for ram automatically applied . . . **Bijur Lubrication** . . . **Timken Bearings**—Bull gear mounted on Timken Bearings. Roller table mounted on Timken Bearings . . . **Modern Design**—built to the highest standards of workmanship and materials—simplified operation, powerful yet finger-tip control . . .

Also built in 12" and 14" sizes

DESIGNED AND BUILT BY **MOREY MACHINERY CO., INC.**

Ask for Circular No. 726

410 BROOME STREET NEW YORK, N.Y.

THREADWELL DOES IT!

NOTE THE CREST

BRITISH
TAPS
BRITISH STANDARD FINE
WHITWORTH
BRITISH ASSOCIATION

THREADWELL LICKS TOUGH THREADING JOBS MAKING "FULL FORM" BRITISH TAPS

Many American industries are working on orders for Great Britian where British form of thread is required. Here at Threadwell all Whitworth, British Standard Fine and British Association High Speed Taps *as small as No. 10 B. A.* are ground with a true "Full Form".

For long life and accuracy these taps are unsurpassed. Their manufacture requires the highest standards of workmanship and the most modern equipment. Threadwell has both - - and will continue to turn out these "Taps of Distinction" in an all-out effort for final victory.

THREADWELL TAP & DIE COMPANY
Greenfield, Massachusetts, U. S. A.

Threadwell

THE NEW NAME FOR
SUPERLATIVE THREADING

NOTE THE ROOT

SALES AGENTS: *Canada* - BRIDGE MACHINERY COMPANY, *Montreal*. *England* - SKYLUX, LTD., *London*.

THE NICHOLS HAND MILLER

» A modern, convenient machine for the volume production of accurate parts . . . .

In the "NICHOLS", the usual features of the hand miller have been combined with a ruggedness of design and construction which makes it a truly production machine tool offering high cutting speeds, maintained precision and long life. A wide variety of operations can be handled at top speed and reduced cost as compared with the same work produced on larger slower machines.

Because of its precision, great versatility and quick set-up, the Nichols Hand Miller is particularly adapted to tool room requirements. Its wide use in this class of service by leading manufacturers is evidence of its recognized value and suitability in meeting the requirements of modern shops.

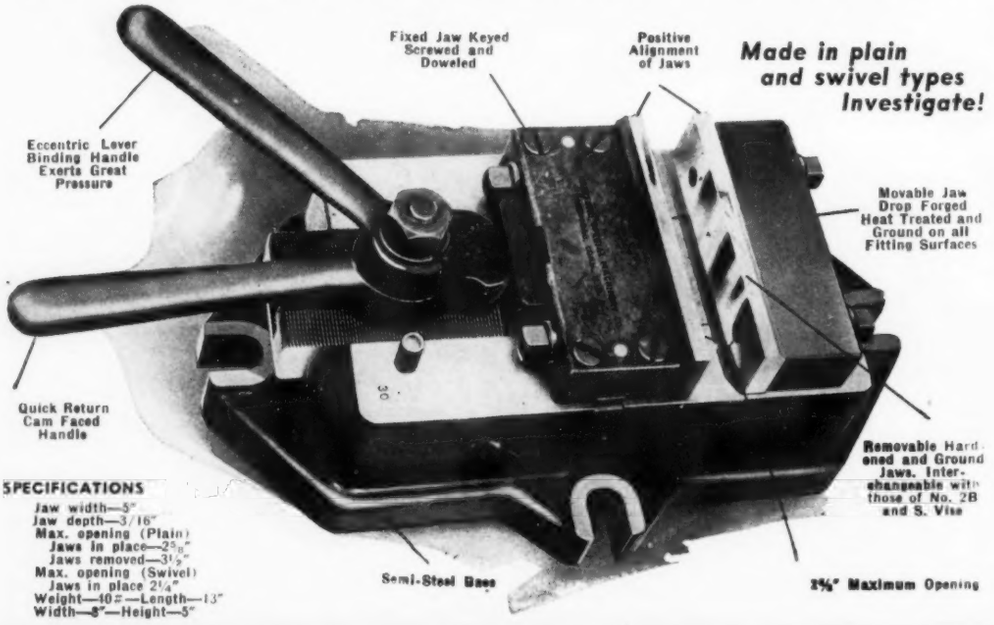
•

Capacity: Longitudinal Feed, 10"; Transverse Feed, 7"; Vertical Feed of Knee, 13½"; Vertical Movement of Head, 4½", Working Surface of Table, 6½" x 21"; Spindle Speeds, 100, 200, 600 and 1200 R.P.M.

Send for Illustrated Bulletin giving Complete Information

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*

TREMENDOUS GRIPPING POWER, ACCURACY and QUICK RELEASE MAKE THE "HARTFORD" THE VISE FOR SMALL ARMS MILLING.....


Fixed Jaw Keyed Screwed and Doweled
Positive Alignment of Jaws
Made in plain and swivel types Investigate!
Eccentric Lever Binding Handle Exerts Great Pressure
Movable Jaw Drop Forged Heat Treated and Ground on all Fitting Surfaces
Quick Return Cam Faced Handle
Removable Hardened and Ground Jaws. Interchangeable with those of No. 2B and S. Vise
Semi-Steel Base
2¾" Maximum Opening

SPECIFICATIONS
Jaw width—5"
Jaw depth—3/16"
Max. opening (Plain)
Jaws in place—2⅝"
Jaws removed—3⅛"
Max. opening (Swivel)
Jaws in place 2¼"
Weight—40#—Length—13"
Width—8"—Height—5"

Scientific construction of the binding and cam-faced handles and absolute alignment of jaws result in tremendous gripping power, quick release and "one-hand" manipulation.

Every part of the "HARTFORD" is made for maximum strength. Base is of semi-steel and movable jaw of drop forged, heat treated steel. Construction of movable jaw with ground fitting surfaces is such that single pieces can be held at either end of jaw without danger of distortion.

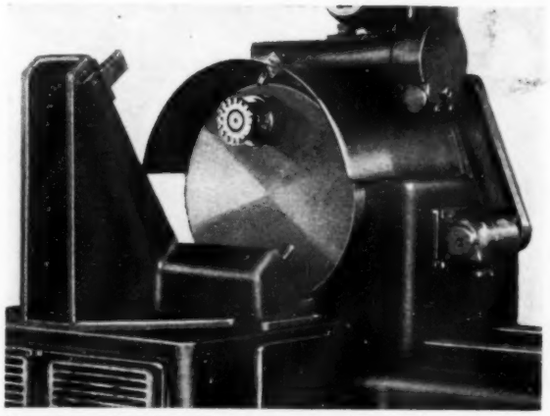
THE HARTFORD SPECIAL MACHINERY COMPANY

HARTFORD CONNECTICUT

Hydraulic feed and rapid traverse move the cutter head transversely on hardened and ground steel ways. A variety of work fixtures can be mounted on the bed.

CROSS SPECIAL *Floor Type Miller*

Cross' development of a Floor Type Miller with traversing head is of particular importance to the manufacturer who was forced to start quickly and at any expense by improvising with standard machine tools. With exceptional range and flexibility, it is constructed to handle a variety of work with little time required for changeover and set-up. The bed is arranged to receive many different kinds of holding fixtures—vertical, horizontal, angular, indexing, compound, rotary feed, rise and fall. The full automatic operating cycle is controlled from a central push button station and it can be set to automatically perform plain face milling, contour milling, profile milling, slotting, rotary milling, and operations requiring the cutter to traverse an irregular path.



The cutter spindle is mounted in a cradle which can be set to oscillate or rotate thru any predetermined arc. Oscillatory and transverse cutter movements may be synchronized to suit the work.

A review of current practice will reveal many opportunities to consolidate operations and put them on an automatic basis with improved accuracy and reduced manpower. Cross engineers are prepared to assist you in applying special machinery to your manufacturing problems.

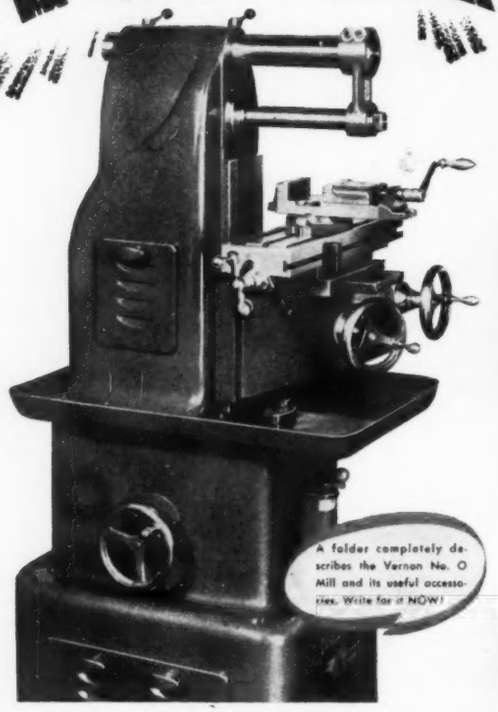
CROSS GEAR & MACHINE CO.

Established in 1898

DETROIT, MICHIGAN, U.S.A.

S-2

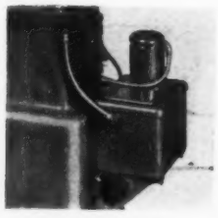
POWER For Heavy Cuts!



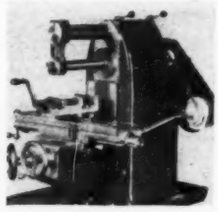
One H.P. motor on Vernon No. O Mill supplies ample power for milling steel, cast iron and other tough metals besides the lighter alloys commonly used in today's defense work. Double Vee belt to spindle transmits power efficiently... eliminates belt slippage even on heavy, slow-speed cuts.

WIDE VERSATILITY

High speed production and difficult setup utility are increased by many accessories especially designed for the Vernon No. O Mill . . . all available as standard extras.



COOLANT SYSTEM – 1/10 H.P. splash-proof motor drives gusher type pump, providing large, steady volume of coolant. Chip strainers are located in return circuit. Unit includes all necessary fittings.



LONGITUDINAL POWER FEED—Permits operator to attend more than one machine on production jobs—saves time... assures uniform cutting... makes smoother finish on all work. Driven direct from spindle. 3 table feeds available.

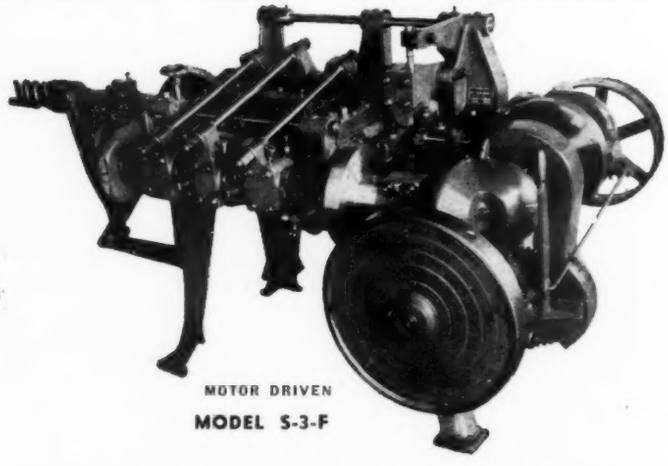
UNIVERSAL VERTICAL MILLING ATTACHMENT – Quickly installed . . . Head swivels and locks at any angle in any plane . . . Maximum distance between collet end of spindle and table top: 10¼"—exceptional capacity even for larger mills.

MACHINERY MANUFACTURING COMPANY
1955 EAST 51 ST VERNON LOS ANGELES CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

STEP UP PRODUCTION OF FORMED PARTS

. . . with the

NILSON AUTOMATIC METAL and WIRE FORMING MACHINES



MOTOR DRIVEN
MODEL S-3-F

Today's requirements for higher efficiency, greater speed and products of greater uniformity and accuracy are met in the new NILSON RIBBON STOCK FORMING MACHINES. These machines are the achievement of over fifty years accumulated experience in designing and building metal forming machines. Careful selection of materials and skilled workmanship result in machines that are famous for long life and low maintenance.

FEATURES THAT CONTRIBUTE TO BETTER, FASTER WORK

Superior features of the NILSON four-slide forming machines are the result of long experience and include:

. . . open construction of press and forming tools.
. . . patented slide feed which has an independent cam-operated wire gripping device.
. . . transmission of power operating wire feed through a straight line.

Send for 4-page circular giving further information as well as detailed specifications of sizes and capacities.

• •

We have been engaged in the design and production of special automatic machinery of high production capacity for over thirty years. We are prepared to render a complete service in connection with the design and production of automatic machinery of every description. Consult Nilson on your requirements.

THE A. H. NILSON MACHINE CO... *Bridgeport, Conn., U.S.A.*

PLANETARY
has the answer
FOR SPEEDIER PRODUCTION

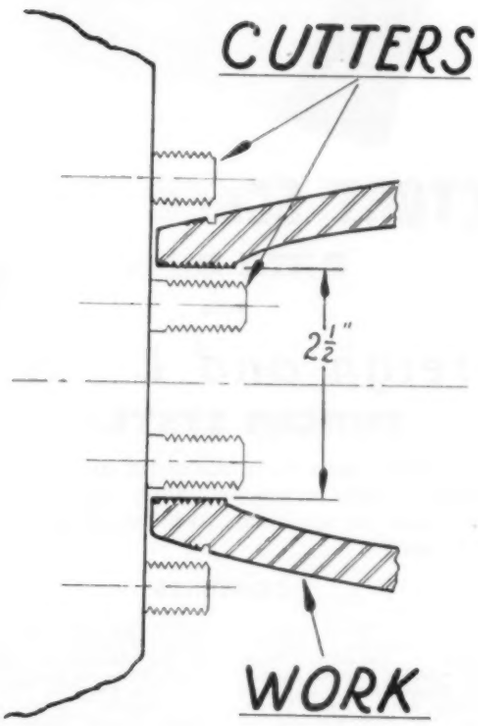
Any variety of threads—all forms of threads, including the most difficult, are easily milled on Hall PLANETARY Machines. The PLANETARY advantages of convenience, speed and accuracy with permanently dependable precision and balance apply to all milling and facing jobs, particularly to pieces that are large and unwieldy.

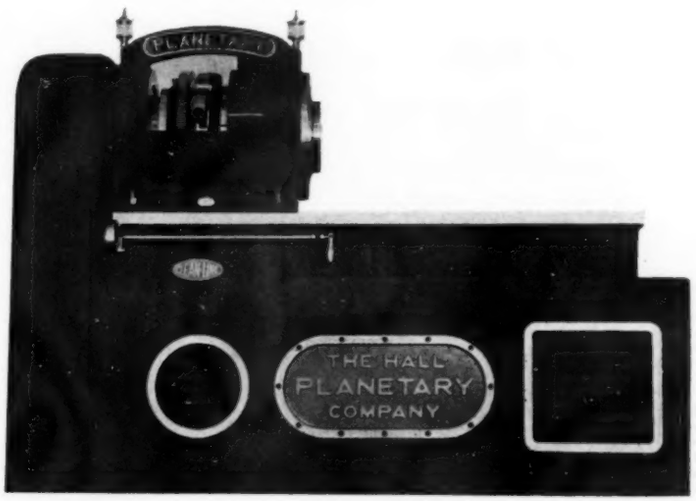
In the PLANETARY the work is stationary; therefore the smooth machining of heavy, difficult work is maintained at top production schedules without the necessity of revolving the job at high speeds.

The diagram on the right illustrates only one of thousands of different jobs being done in record time on Hall Planetary Machines. Send blueprints for estimates.

2 THREADS MILLED SIMULTANEOUSLY

THIS JOB IN 90 SECONDS →





Write for
COMPLETE DETAILS

HALL PLANETARY COMPANY

Fox Street and Abbotsford Avenue
PHILADELPHIA, PA.

The Book of the YEAR!

VICTORY SCREW THREAD
DATA BOOK
With
Foreign and Domestic
THREAD SYSTEMS

● This Book answers 99 out of 100 questions about threading that come up daily with and contains data never before assembled in a single publication.

CONTENTS

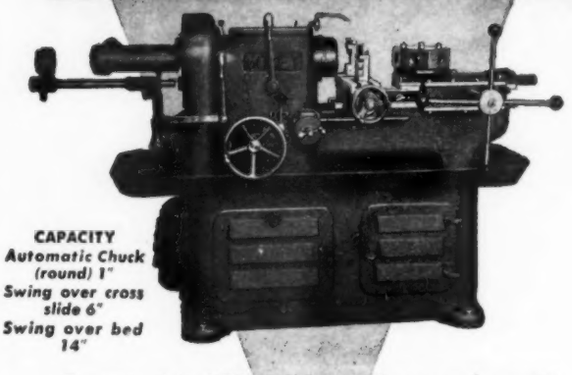
Definitions * Thread Series * Fits (Description) * Marking Symbols * Stockable Chaser Sizes * coarse Thread Series—Basic Dimensions * Proposed National Extra Fine Thread Series * 27 Pitch Lighting Fixture and Brass Tubing Threads * Fine Thread Series—Basic Dimensions * Tolerances for Screws and Nuts Class 2 and 3 * 8, 12 and 16 Pitch Series * Class 2 Tolerances for Coarse and Fine Thread Series for Screws and Tapped Holes * Tap Drill Sizes for National Coarse and Fine Threads * American National Pipe Threads—Straight Pipe Threads * Acme Threads * Stub Acme * SAE Fuel, Oil and Tube Fitting Thread * Stub 60° Thread * Spark Plug Thread Sizes. British Standard Whitworth * British Standard Fine Thread * British Association Thread * Cycle Engineers Institute Thread * British Standard Pipe—Taper and Straight * International Metric Thread * French Standard Thread * Lowenherz Thread—Decimal Inch Equivalent of Millimeters * Equivalent of Metric Pitches in Inches and Threads Per Inch * Three Wire System of Measuring Threads * Decimal Equivalents * Single and Double Depths of American National Whitworth and V Threads Compared * Cutting Speeds—Surface Feet * Weight of Bar Stock Per Foot * Guide for the Design and Purchase of Screw Machine Products * SAE Steels (Analysis) * Comparison of British and American Nickel Alloy Steels.

FREE to Factory Executives
who request it on a business letterhead;
others, 15 cents.

The Eastern Machine Screw Corp.
21-41 Barclay St. **New Haven, Conn.**

for ECONOMY—*for* HIGH SPEED PRODUCTION

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds



CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

PUMPS TO KEEP PRODUCTION CLIMBING
Reliable — Adaptable — Efficient

Geared - Vane - Centrifugal — a wide range of sizes for various applications.

B·S **Brown & Sharpe Mfg. Co.**
Providence, R. I., U. S. A.

BROWN & SHARPE PUMPS

SAVE THOSE BLADES!

You can and should use more than one-half the length of Lovejoy blades

To cooperate with the Government's campaign to save scarce metals, we urge you to get full use out of every Lovejoy blade used in Lovejoy milling cutters.

Be sure to use over one-half your Lovejoy blades (or more on light cuts) — otherwise valuable metal is wasted. Lovejoy's *positive-locking* device guarantees that short blades are held as rigidly as new blades.

When you have used the blades to the limit, *then* order new Lovejoy High Speed Steel, Stellite, Rexalloy, etc., blades — all standard sizes are carried in stock for immediate shipment.

Lovejoy offers a retipping service for Cemented-Carbide blades — information on request.

LOVEJOY
TOOL COMPANY, Inc.
SPRINGFIELD, VERMONT, U.S.A.

NEW
A new Lovejoy blade

SAVE
Still plenty of life left

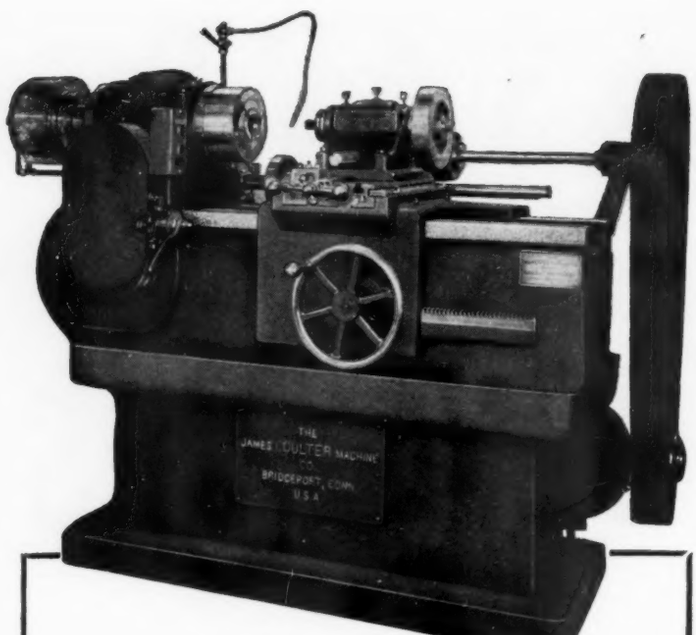
SCRAP
Sell blades like this to Uncle Sam — he needs them

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

THE CENTRAL *Certified Accuracy* MICROMETER

Developed and Perfected by America's Only Makers of Micrometers Exclusively

All sizes up to 6 inches available with graduations by thousandths of an inch.

★

All sizes up to 4 inches are also available with graduations by ten thousandths of an inch.

CENTRAL

FOR MORE THAN A QUARTER CENTURY SPECIALISTS IN FINE MICROMETERS

CERTIFIED ACCURACY
THE CENTRAL Certified Accuracy MICROMETER
GUARANTEE
This micrometer is triple tested and is guaranteed accurate. If for any reason you are dissatisfied with this tool, return it with this guarantee within 30 days of purchase date to dealer from whom you purchased, and full purchase price will be refunded.
This guarantee, of course, is void in case of breakage, abuse, accident or other cause not inherent in the tool itself.
The Central Tool Co.
MICROMETERS OF CERTIFIED ACCURACY
AUBURN, RHODE ISLAND

Central
THE CENTRAL TOOL CO.
AUBURN . . .
RHODE ISLAND
MICROMETERS OF CERTIFIED ACCURACY

64

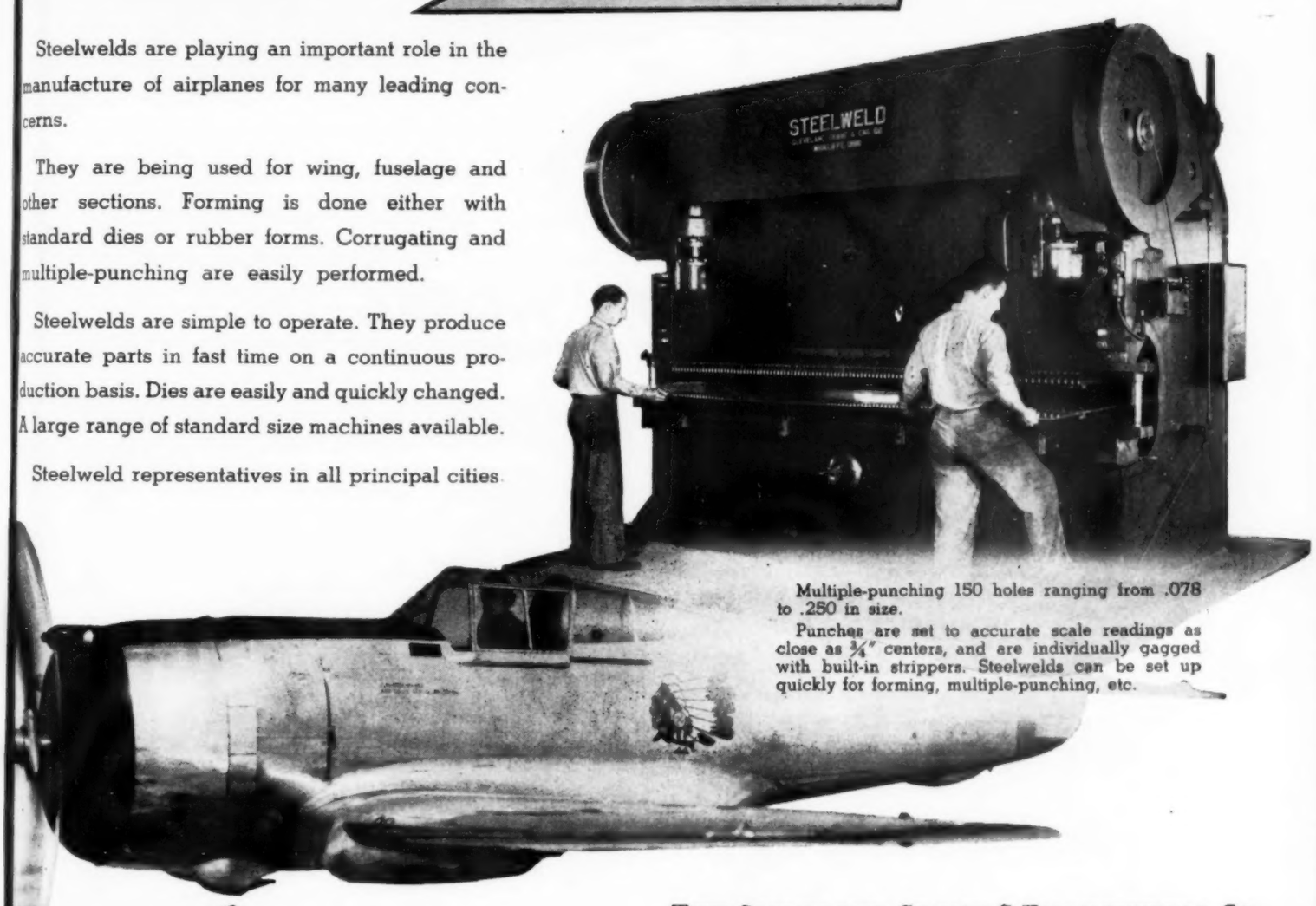
STEELWELD PRESSES NOW SERVING THE AIRCRAFT INDUSTRY

Steelwelds are playing an important role in the manufacture of airplanes for many leading concerns.

They are being used for wing, fuselage and other sections. Forming is done either with standard dies or rubber forms. Corrugating and multiple-punching are easily performed.

Steelwelds are simple to operate. They produce accurate parts in fast time on a continuous production basis. Dies are easily and quickly changed. A large range of standard size machines available.

Steelweld representatives in all principal cities.



Multiple-punching 150 holes ranging from .078 to .250 in size.

Punches are set to accurate scale readings as close as ¾" centers, and are individually gagged with built-in strippers. Steelwelds can be set up quickly for forming, multiple-punching, etc.

GET THIS BOOK!

CATALOG No. 2002 gives complete construction and engineering details. Mail request for free copy on your company letterhead.

THE CLEVELAND CRANE & ENGINEERING CO.
STEELWELD MACHINERY DIVISION
1127 EAST 283RD STREET • WICKLIFFE, OHIO.

MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

STEELWELD
BENDING PRESSES

GENERAL SALES AGENTS: CYRIL BATH & CO., E. 70TH & MACHINERY AVE., CLEVELAND

NEW ROCKFORD PRESSES

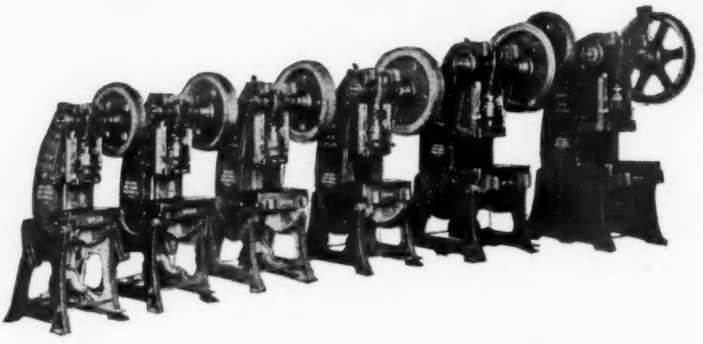
ANNOUNCING!

Removal of our plant and offices to—

6411 W. BURNHAM AVE.
MILWAUKEE, WISCONSIN

Prompt deliveries possible on certain sizes

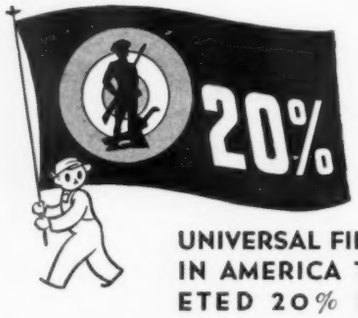
WIRE **WRITE**



The INCLINABLE Line—14 to 100 Ton—
EMBODIES EVERY MODERN FEATURE

DIMENSIONS	1R	2R	3R	4R	5R	5½R	6R	7R	8R
Diameter of crankshaft at bearings and crankpin	1⅞–2¾"	2¾–3½"	2½–3¾"	3–4½"	3½–5¼"	4–5¼"	4–6"	4½–6¾"	5–7½"
Standard stroke of slide	2"	2"	2"	3"	3"	3"	3"	4"	4"
Maximum stroke of slide	4"	5"	6"	6"	7"	7"	8"	8"	10"
Area top of bolster, F to B by R to L	9½x16½"	12x19"	13x22"	14x26"	18x32"	18x32"	21x34"	24x41"	27x45"
Approximate weight Fly Wheel Press	1275	1890	2900	4500	7600	7700	9700	18500	24000
Approximate weight Single Geared Press	1350	2100	3400	5100	8750	8900	10700	20000	25600
Tons pressure (rated)	14	20	26	37	50	56	65	85	100

ROCKFORD IRON WORKS, INC.



UNIVERSAL FIRST COMPANY IN AMERICA TO WIN COVETED 20% BOND FLAG

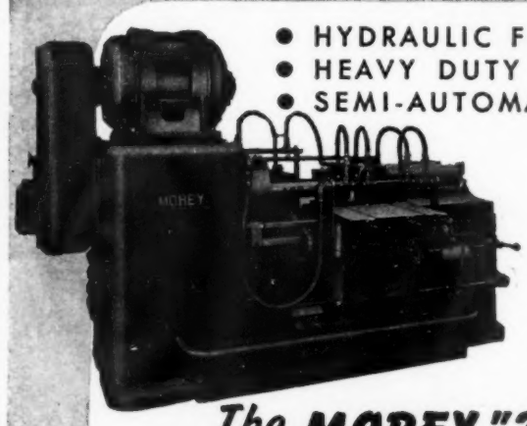
When each of the 550 of us here at Universal helped give the Allied cause a boost by being America's first industrial plant to subscribe 20% for War Bonds we were mighty proud.

But we're even more proud of the big volume of precision built drill bushings we're turning out daily to help America's arms production.

Universal drill bushings (such as the one shown here) are straight and round with superfinished bores which assure accuracy and unexcelled wearing qualities. Write for facts.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN

Suitable for 105 M.M. to 155 M.M. Shells



- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

The MOREY "27" SHELL LATHE

Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

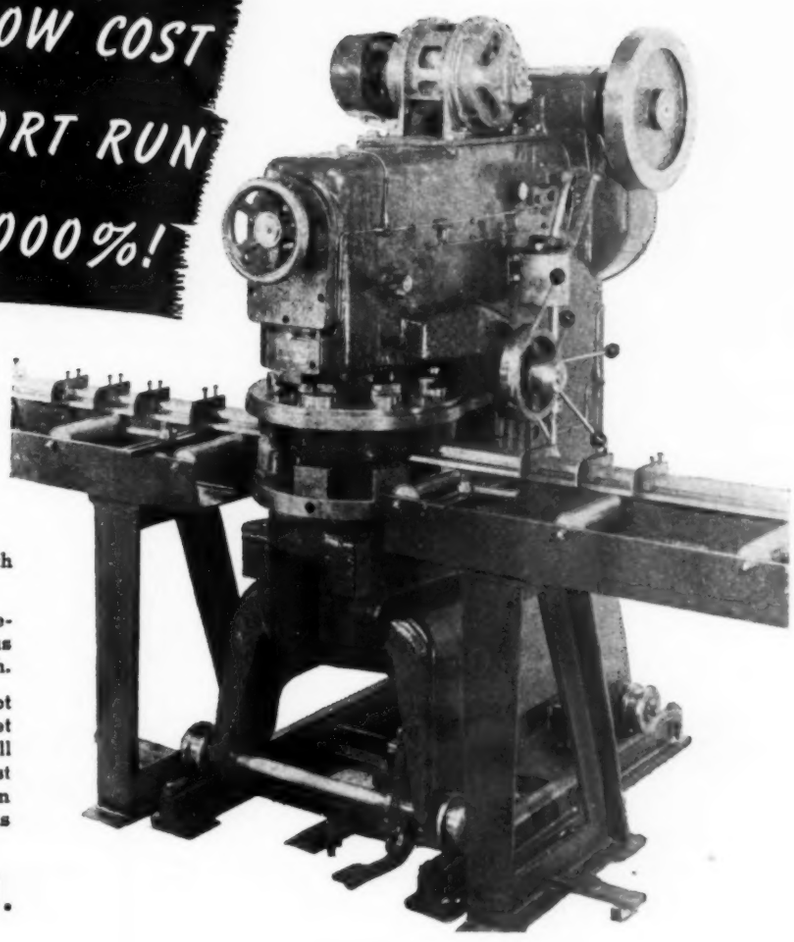
The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

IT'S WIEDEMANN TURRET PUNCH PRESSES

for Piercing Copper Bus Bars at I-T-E Circuit Breaker Company

TIME STUDIES SHOW COST SAVINGS ON SHORT RUN JOBS UP TO 2,000%!



The Switchboard Division of I.T.E. produces custom built jobs exclusively — copper must be punched to specifications on each order in lots of from one to 3000 pieces in sizes ranging from ¾" x ⅛" x 1" to 6" x ¼" x 120".

The Wiedemann R-5's used at I.T.E. contain 12 stations — 4 with single punches; 5 with double punches; 3 with quadruple punches.

The work is positioned without layout on Wiedemann gauge tables designed to handle ¼" bus bar up to 12 feet in length and 8 inches in width.

Such amazingly fast production times are not unique. Hundreds of users of Wiedemann Turret Punch Presses with gauge tables are producing all types of accurate short run piercing work at almost unheard of low cost. A wide variety of Wiedemann Turret Punch Presses is available from 6 to 80 tons capacity.

WIEDEMANN MACHINE CO.

1819 Sedgley Avenue

Philadelphia, Pennsylvania

EXPLANATION OF WIEDEMANN METHOD VERSUS CONVENTIONAL METHODS

THE OLD METHOD of piercing was done in single operations. Each piece was laid out on short runs. On longer runs layout was made and back gauge and stops were set to layout.

WIEDEMANN METHOD — Single punching is used only where necessary, otherwise gang punches, consisting of 2 to 4 punches, is used.

No layout is required. All stops are set by direct reading from blue print.

	SETUP (Std. Hrs.)	PIERCING (Std. Hrs. Per Pc.)
Old	.6	.075
New	.0510	.0121
% Savings	1,060%	510%

Old	.8	.054
New	.0440	.0232
% Savings	1,720%	133%

Old	.7	.025
New	.0294	.0042
% Savings	2,280%	490%

GET THE FACTS

Write today for a new descriptive booklet detailing the Wiedemann Method of Producing Short Run Piercing jobs at long-run low cost. A copy is yours for the asking.

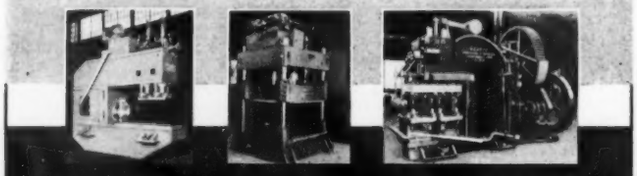
WIEDEMANN TURRET PUNCH PRESSES & GAUGE TABLES

BOTTLESHIPS or *BATTLESHIPS?*

America is racing against TIME! The program is a gigantic one! What we build now are not MUSEUM-PIECES nor mantel ORNAMENTS . . . but real-size ARMAMENTS. Ships, tanks, guns, planes — all must be built by the fastest, most efficient methods known. Our job, as designers and builders of heavy metal-working equipment, is to help you attain the PRODUCTION RECORD which the President has set. If you have a production problem involving our line of equipment, let a BEATTY ENGINEER help you make TWO ship plates grow where ONE grew before . . . or other equally vital heavy metal fabrication problems. No obligation on your part.

BEATTY MACHINE AND MFG. COMPANY HAMMOND, IND.

Builders of Heavy Metal Working Tools



Illustrating a few of Beatty's complete line of Hydraulic Forming Presses, Shears, Forcing Presses, Single- and Double-end Punches, Extruding Presses, Coping Machines, and others.

WITH PRODUCTION UP TEN-FOLD

DELIVERIES ARE PROMPT (and we mean prompt)

. . . a real achievement for

MILFORD

PROFILE SAW

. . . today's choice for ALL contour-sawing, jig and band saw machines.

Yes, our production today is ten times more than it was in pre-war days. Added manufacturing equipment has made it possible for us to accept and fill huge war production contracts, as well as a greatly increased industrial demand, *and still maintain our stocks and make fast deliveries.*

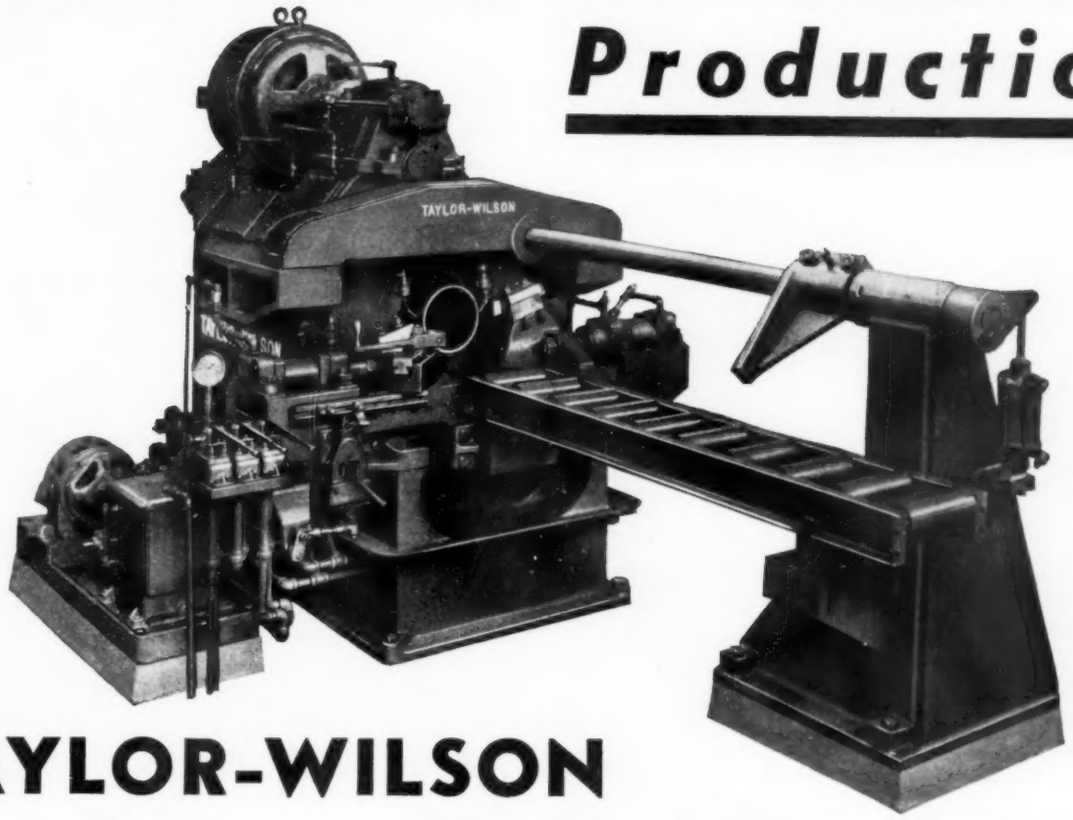
So you can order MILFORD PROFILE SAW with confidence . . . confidence in its quality, as guaranteed by the world's largest producer of metal cutting band saw . . . confidence that you'll get it when you need it.

Order from your Mill Supply Distributor

If you haven't yet adapted your band saw machines to Profile Sawing, write us for directions. Include specifications of machines and cutting jobs you'd like to do on them.

THE HENRY G. THOMPSON & SON COMPANY
NEW HAVEN, CONNECTICUT
Also makers of MILFORD REZISTOR HACKSAW BLADES

Faster and More Accurate Production



TAYLOR-WILSON
Cutting-Off Machine

In war plants throughout the country Taylor-Wilson Cutting-Off Machines are performing with speed and accuracy, making it possible to step up schedules of vital production for our fighting forces.

Taylor-Wilson Machines are sturdy, vibrationless, long lasting, and accurate at all speeds within the limitations of the cutting tools. Many of them in many plants are saving valuable time in cutting off pipe or tubing for Coupling Stock, Roller Bearing Blanks, Bomb Blanks and other vital production. Sizes 1" to 24" Diameters.

Write for Descriptive Literature

TAYLOR-WILSON MFG CO.

35 Thomson Ave., McKees Rocks, Pa.

PITTSBURGH DISTRICT

Here at last **is an OUTSTANDING high-production COLD METAL SAWING MACHINE—**

Cuts stock from 3 inches up—Handles multiple cutting of small bars or shapes . . . . . .

The outstanding high capacity and speed of this new 8" Porter-McLeod machine—for general work or for production work in single or multiple units—are attained through modern, unique features of design which assure faster, cleaner, more accurate cutting.

Upper feed of the machine permits "nesting" of economical quantities of bars or shapes using our systems of multiple or interchangeable "nests" which give support to each nest on both sides and bottom.

To insure accuracy and protect against blade damage at times when hard spots are encountered in cutting, friction disc feed is provided. Further protection is assured and weaving and buckling prevented by supporting the blade close up to its rim and by *pulling the blades upward through* the cut. This method of feed and drive also results in lower power requirements and straight cuts under all conditions.

Standard feed is 3 inches per minute. This, however, can be stepped up for cutting such materials as brass or other non-ferrous metals.

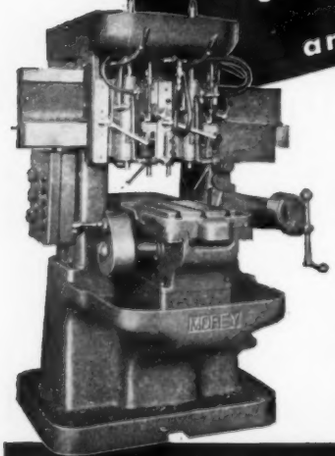
Investigate the Porter-McLeod Production Cutting-Off Machine Today. Details available promptly on request.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

Preloaded Precision Bearings for Spindles

MOREY 12M
HIGH-SPEED VERTICAL PROFILER and MILLER



Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.

ERRINGTON

Main Office and Works, Stapleton, Staten Island, N. Y.

TAPPING CHUCKS

NEW YORK
170 Broadway

BOSTON
830 Old South Bldg.

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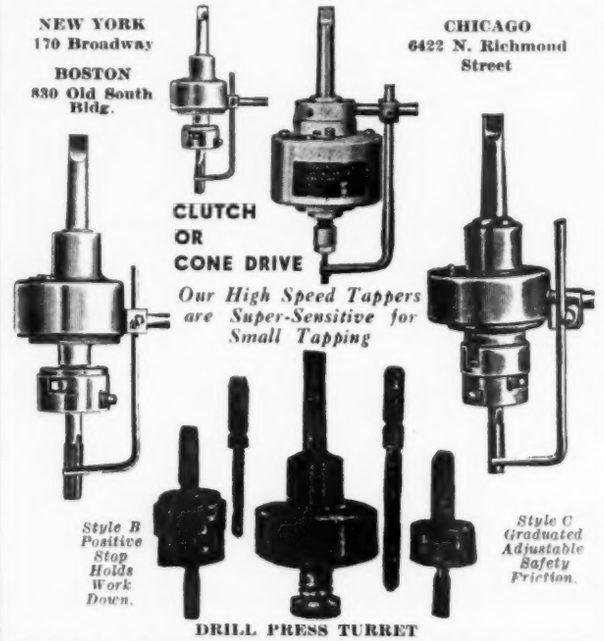
6422 N. Richmond Street



CLUTCH OR CONE DRIVE

Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down.

Style C Graduated Adjustable Safety Friction.

DRILL PRESS TURRET

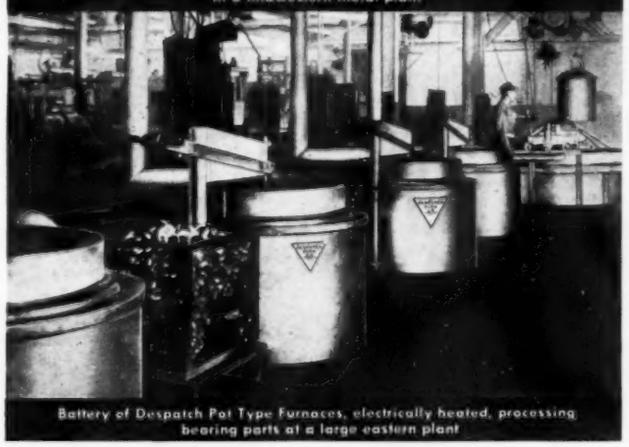
Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustments in each tap-holder, if required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

Actual Reports show

Big Increase In Production of TOOLS · DIES PRECISION PARTS *with* DESPATCH FURNACES

Despatch Batch Type Furnace, gas heated, processing steel springs in a midwestern metal plant



Battery of Despatch Pot Type Furnaces, electrically heated, processing bearing parts at a large eastern plant

This is no time to compromise with production. Speedy, accurate heat treatment is needed to achieve the output of tools and dies scheduled for this year.

Actual reports show that greater reproduction of tools, dies and precision parts is attained after the installation of Despatch furnaces.

Investigate the advantages of Despatch heat treating furnaces for your plant. 64 standard models, gas or electric, pot type or batch type furnaces available for prompt delivery. Also special models to suit any material handling necessary.

Wire—phone or write for a Despatch engineer to recommend the proper heat treating furnace for your plant.

DESPATCH OVEN COMPANY MINNEAPOLIS

Now! *A Complete Manual on* **MARKING DEVICES** *For Every Industrial Use*

Request A Copy On Your Letterhead!

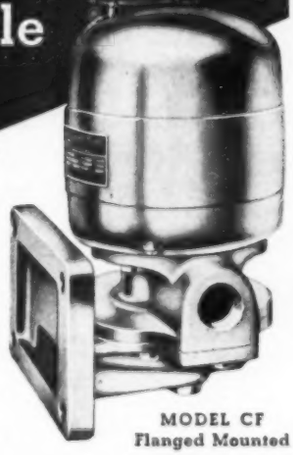
Plant Managers! Superintendents! Purchasing Agents! Production and Plant Engineers! Here's a book that will give you the answers to your marking problems. It contains hundreds of illustrations, with concise descriptions of Marking Devices for every Industrial Marking application. Yours for the asking . . . request a copy on your letterhead today!

JAS. H. MATTHEWS & CO.
3956 FORBES ST. ∴ PITTSBURGH, PA.
New York—Chicago—Phila.—Boston—Detroit—Newark—Syracuse
DISTRICT SALES OFFICES · CLEVELAND · HARTFORD · BIRMINGHAM

GILBARCO COOLANT PUMPS dependable... durable

- One of a complete line of pumps for all machining operations.
- Built for twenty-four hours a day service.
- Instantaneous coolant delivery, self-priming, never becomes air-bound.
- Does not build up pressure at slow speeds.
- Positive mechanical seal, ball bearings throughout—unharmed by running dry.
- Built by one of the country's largest pump manufacturers.

Write or wire for literature, prices and deliveries.



MODEL CF
Flanged Mounted

GILBERT & BARKER MFG. CO.
WEST SPRINGFIELD, MASS.

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

GAGES—PUNCHES—DIES—ETC.
HEAT TREATING FACILITIES
BARTON MACHINE & TOOL CO.
PRECISION TOOL MAKERS
14 Taft Street — Pawtucket, R. I.

METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT-TREATING
THOMAS & SKINNER
STEEL PRODUCTS CO.
1102 E. 23rd St. INDIANAPOLIS, IND.

THE NORLIPP COMPANY
Engineers . . . Manufacturers
Sub-contract facilities for die castings and metal stampings
556 West Congress Street — Chicago, Illinois

DESIGN & BUILD
JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
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PAWTUCKET, R. I.

FOR YOUR IMMEDIATE USE
5,000 MAN HRS. PER WEEK OF TOOL, DIE AND SPECIAL MACHINE DESIGNING
Est. 1930
PRODUCT ENGINEERING SERVICE
Tel. OL 3300 3301
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DESIGNERS OF
Jigs, Fixtures & Dies
Prompt Service
LAWRENCE W. SECREST CO.
P. O. Box 265
Alexandria — Virginia

Designers and Builders of Jigs, Fixtures and Small Tools.
Also Manufacturers of Automatic Turret Head for 10 inch Lathes.
Complete Details upon Request
GAS MODEL RESEARCH CO.
21 Market St. — Rockville, Conn.

MACHINE SHOP
Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmenship assure your satisfaction. Your inquiries invited.
C. VANDEGRIFT CO.
HOCKESSIN — DELAWARE

PUT YOUR IDLE CAPACITY TO WORK!
Hundreds of metal-working companies are finding profitable business today *outside* their regular lines.
You, too, can put your idle machines and equipment to good use by directing attention to them through American Machinist's CONTRACT WORK SECTION.
American Machinist's net paid circulation of over 21,000 reaches the men who need and can authorize sub-contracting.
Tell your story to these men through American Machinist's CONTRACT WORK SECTION. We will gladly send you complete information at no obligation.
CONTRACT WORK DEPARTMENT
AMERICAN MACHINIST — 330 W. 42d St., New York, N. Y.

WORK WANTED FOR
Cylindrical Grinder 10"x54", Horizontal Boring Mill 2½" bar, Lathes, Milling Machines, Shapers, Drill Presses, Hand Screw Machines, Foot and Power Presses, Bench.
HAIDA ENGINEERING CO.
24-11 Vernon Blvd. Long Island City, N. Y.

COMMERCIAL HEAT TREATING
Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories
AGERSTRAND CORPORATION
Muskegon, Michigan

CAPACITY AVAILABLE
FOR
THREAD MILLING WORK
Write
Box 331 American Machinist
338 West 42nd St., N. Y. C.

NEED SUBCONTRACTORS?
If you can't find the facilities or services you need advertised here, we may have the company that can help you listed in our files. Write.
CONTRACT WORK DEPARTMENT
American Machinist, 330 W. 42nd St., N.Y.C.

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

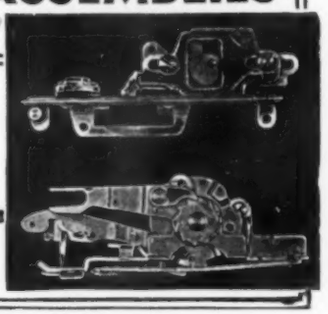
KIRK & BLUM

CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR
OTHER ALLOY FABRICATION
OUR SPECIALTY
CAPACITY 3/8" AND LIGHTER

THE KIRK & BLUM MFG. CO.
2823 SPRING GROVE AVE. CINCINNATI, OHIO

STAMPINGS AND ASSEMBLIES

"GREATER SAVINGS WITH GREIST"



We can make short or long runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. We are also fully equipped to make

SCREW MACHINE PRODUCTS
TOOLS, DIES, JIGS, FIXTURES

Quality work by skilled mechanics is assured. Send your blueprints or samples today!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication.

CONTRACT WORK—

We can build machines and parts, special tools and fixtures of all kinds to your specifications and design. Skilled workmen and modern equipment are your guarantee of satisfaction. The design and building of wire and ribbon stock forming machines are our specialty.

We solicit your blueprints or samples for quotation. No obligation of course.

THE A. H. NILSON MACHINE COMPANY
Bridgeport, Conn.

FORGINGS

● All types up to 6,000 lbs. Smooth Forged—Finished—Rough Turned, Hollow Bored and Heat Treated to Specifications. Crank Shafts—Shafting—Connecting Rods

BAY CITY FORGE CO.
ERIE PENNSYLVANIA

MACHINISTS AND ENGINEERS
FIDELITY
MACHINE COMPANY
3908-18 Frankford Ave. Phila., Pa.
Jefferson 7600-1-2

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy
SPECIAL MACHINERY
CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL.

BRAZING

HYDROGEN ELECTRIC FURNACE PROCESS

MODERN CONTINUOUS
HIGH PRODUCTION EQUIPMENT

ALSO—BRIGHT ANNEALING

THE QUEEN CITY STEEL TREATING CO.
CINCINNATI, OHIO

SPUR GEAR AND SPROCKET CUTTING

Have three automatic machines available—range 1" to 6' diameter.

OHMSTEDE MACHINE WORKS
897-899 N. Main St. Beaumont, Texas

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.

KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

Need steel balls for defense assemblies ?

The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.

ABBOTT BEARING BALLS

WIRE AND METAL SPECIALTIES

In round, flat, square and special shaped wire in all metals.

LARGE PRODUCTION CAPACITY
Plating and finishing.

EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

PATTERNS in WOOD and METAL

For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY

Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.

GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time salaried employment only), ½ above rates.
PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M., October 19th will appear in the issue of October 29th, subject to limitations of space available

POSITIONS VACANT

(See also "Selling Opportunity" Offered)

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

PRODUCTION MANAGER. For Eastern die casting plant. Must have die casting experience and ability to take full charge and supervise production methods and personnel. The man who can get results from this plant, will receive adequate compensation. Reply fully stating experience and salary expected. Box #444, 1457 Broadway, Suite 617, NYC.

PROJECT ENGINEER—To fill position covering engineering contacts, experimental development work, and miscellaneous mechanical and electrical accessories in the aircraft field. Engineering school and practical experience background. Must have draft deferment and not presently employed in war industry. Titeflex Metal Hose Co., 500 Frelinghuysen Avenue, Newark, N. J.

MAN WANTED, for estimating and time setting in Instrument Manufacture, near Washington, D. C. Not a war job, although we are engaged in war work. Give full details of age, experience, etc. P-332, American Machinist, 330 W. 42nd St., New York, N. Y.

RATE SETTER—experienced in machine shop rate setting to train for position as head department rate setter. Write giving full details, education and experience, draft status and salary desired. Enclose small snapshot (not returnable). No person at present employed in War Work will be considered. General Castings Corp., Eddystone, Penna.

DRAFTSMAN OR TOOL DESIGNER for instrument shop. State experience, age, draft status. P-334, American Machinist, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

Manufacturing Executives and Technical Men, chemists and metallurgists immediate openings throughout country. Salaries $2500 to $20,000 year. Write for application. Confidential. Established 27 years. Harrison Personnel Service, 20 W. Jackson, Chicago.

POSITIONS WANTED

EXECUTIVE with twenty-five years experience as Chief Engineer, Superintendent and Works Manager. Well versed on modern methods and equipment. Available October 1st. PW-308, American Machinist, 330 W. 42nd St., New York, N. Y.

Assistant General Foreman wanted

for scraping, fitting, assembling departments, Machine Tool Plant. Preferably under 45 years of age. Must be capable of directing work, know how to handle men, and be qualified to introduce improvements. Location New Jersey. State Qualifications, Nationality, salary expected in first letter.

P-317, American Machinist
330 West 42nd St., New York City

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

A SALESMAN—Worthwhile opportunity for future financial security—selling industrial operating supplies. Atlantic Seaboard States territory open for mature salesman 35 to 50 with mechanical education or training. Immediate selling experience must include selling to industries where it was necessary to sell both the Purchasing Agent and operating or engineering men. Must be American citizen, own a usable automobile. Salary plus commission, traveling and car expenses. Give full particulars. SW-333, American Machinist, 330 W. 42nd St., New York, N. Y.

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W. Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on page Facing inside back cover.

ORGANIZATION

Selling machine tools to manufacturers in Illinois and surrounding states wants line of tools or motors. Have several acquainted salesmen. Exhibit rooms, bank references.

RA-336, American Machinist
520 No. Michigan Ave., Chicago, Ill.

NEW ITEMS WANTED

Sales organization covering US & Canada seeks additional items in tool or equipment field must be adaptable for war and post war sales.

RA-337, American Machinist
520 No. Michigan Avenue, Chicago, Ill.

FOR SALE

PATTERNS AND DETAIL DRAWINGS OF Surface Grinder

7" x 20" Mechanical Feed Excello Spindle. Sample machine has been operating successfully for two years in plant production.

BO-320, AMERICAN MACHINIST
330 W. 42nd St., New York, N. Y.

PROFESSIONAL SERVICES

MORRIS AND VAN WORMER
Est. 1924
Industrial Engineers
WAR PRODUCTION
METHODS — DESIGN — QUALITY
PLANT LAYOUT — CONVERSION
25 Broad Street New York City

ALFRED HERBERT LTD.
COVENTRY, ENGLAND

OFFICES AND SHOWROOMS AT—LONDON, COVENTRY, GLASGOW, MANCHESTER, BIRMINGHAM, SHEFFIELD, BRISTOL, NEWCASTLE, CALCUTTA, BOMBAY, SYDNEY MELBOURNE, BUENOS AIRES

representing a number of leading United States makers of machine tools and workshop equipment can undertake additional agencies.

POSTWAR PRODUCTS
WANTED

Long established, responsible manufacturing and sales organization seeks postwar products. Machinery, equipment or consumer goods. Confidential.

P. O. Box 502
Northwestern Station
DETROIT, MICHIGAN

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

BAR STOCK WANTED

We will purchase any available surplus stocks of round bars, hot rolled or cold drawn, in the following grades of steel:

SAE Nos.

2320	2340	3130
2330	3115	3135
	3120	

MODERN COLLET AND MACHINE CO.

401 Salliotte St. Ecorse, Mich.

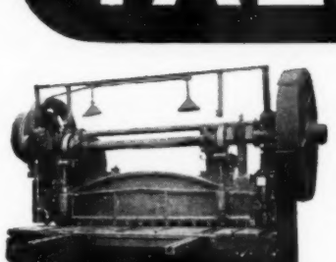
WANTED
MILLING MACHINES

Five **Brown and Sharpe** Number 1 Y Milling Machines—used or rebuilt—in good condition.

Write Purchasing Agent,
Eastman Kodak Company,
Hawk-Eye Works
1417 St. Paul Street Rochester, New York

When You Need Machine Tools Check "FALK'S" Stock

"FALK" for DEPENDABILITY in Rebuilt Machinery



There is no occasion to gamble on the quality of the rebuilt machinery which you buy for plant extension, when taking on more War work.

Check "FALK'S" stock and have your experts examine the quality and mechanical condition of the machinery in our stock here ready for your immediate use.

"FALK'S" DEPENDABILITY is known to big users of machine tools throughout the Nation. If you don't see what you need here, listed on this page—write us and we will likely be able to meet your requirements.

MULTIPLE PUNCH

CINCINNATI 60" 100 Ton, Geared
THOMAS Spacing Machine, 42" wide now arranged for Plate shear 1¼"x42" cap. with Table
SHUSTER WIRE STRAIGHTENER AND CUTOFF, ⅛"x10'

KEYSEATERS

#3½ BAKER—72"x3"
#1 LaPointe horiz. Broach
#4 LaPointe horiz. Broach
12" New Haven Slotter, Rotary Table

TURRET LATHES

#4 MILLHOLLAND-LASSITER, Staybolt Threader
#7—FOSTER UNIVERSAL, 2 9/16" cap.
21"x3¼" hole, GISHOLT UNIVERSAL (2)
24"x5" hole; GISHOLT UNIVERSAL

AUTOMATICS

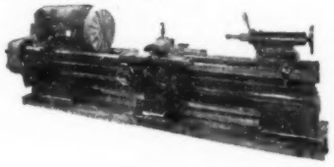
1¼ GRIDLEY Model "F" 4 spdle.
9/16 GRIDLEY Model "G" 4 spdle; (2)
#24 Prentice New Britain auto. Chucker
#23 Prentice New Britain auto. Chucker
12"x6" Jones & Lamson "Hartness" Chucker

IPE MACHINES

18" SAUNDERS, M.D.
12" MERRILL, M.D.
6" WILLIAMS, M.D.
4" CURTIS Portable, M.D.
2" LANDIS, belt
2" JARECKI, belt

LATHES

42x25' PUTNAM
36"x18' PRENTISS
27"x16' New Haven Heavy
24"x12' PUTNAM, QCG
24"x14' REED-PRENTICE Geared Hd.
22"x16' REED light pattern, cone
18"x10' Rahn-Larmon
19"x8' LeBlond Hvy. Duty, Pl. Turning
18"x6' South Bend
16"x6' South Bend
14"x6' Monarch Geared Hd.
12"x5' Champion, Pl. cone
10"x4' Davis Pl. Chnge
10"x24" centers, LOGAN (new)



GRINDERS

GARDNER #14 double opposed Disc
BESLEY #6 double opposed Disc
GORTON 24" DISC and Ring Wheel
GARDNER #4 DISC 23", Ring Wheel 16" Universal Tables, belt dr.
CINCINNATI #2—12"x36" CYLINDRICAL, M.D.
SPRINGFIELD FACE GRINDER, 12" CUP WHEEL,
ROGERS 60" KNIFE GRINDER
FLOOR GRINDERS, B-LINE (NEW) 12x2 Wheels; 2 horse power, Ball Bearing; fully enclosed, adj. Wheel Guards, exhaust Takeoff, electric lights; Tool supports; in-built switch. $175 any voltage.

GEAR MACHINERY

GLEASON GEAR TESTER
WHITON #2 SPUR GEAR CUTTER, 36" cap.
BARBER-COLMAN #12 HOBBER
GOULD & EBERHART 36" Victoria Model
GOULD & EBERHART #36B, Spur and Bevel
ADAMS #1 Gear HOBBER
Van Norman Pinion Cutter, Small
Van Norman Pinion Cutter 3" cap.

DRILLS

SIPP-FOOTE-BURT 4 Spindle, power feed and quick return
Sipp—2 spindle #2 M.T.
AVEY 3 Spindle #2 M.T.
Avey 2 Spindle #2 M.T.
Leland-Gifford 2 spindle #2, 10" Overhang
ALLEN 2 spindle #2 M.T., Motorized
AVEY #3 single spindle Power feed, #3 M.T. 24"
AVEYMATIC single spindle with power feed; 20"
100 Spindles of High Speed sensitive, Ball Bearing Drill Presses made by Avey, Leland Gifford, Allen; Foote-Burt, Henry & Wright, Fosdick
New "BUFFALO" DRILLS—all sizes, many in stock

THREADING MACHINES

ACME 1" two Spindles, cone
Landis 1½" Two Spindles; cone dr.
NATIONAL 2" Two Spindles, Motor dr.
ACME 2½" Single Spindle, Cone Dr.
Landis 1½" Single Spindle, cone dr.

COMPRESSORS—AIR

12"x10" INGERSOLL-RAND ERI with A.C. 50 H.P. Slip Ring Motor, etc.
10"x8" LAIDLAW, arr. Chain Motor Dr.
10x8x4 AMERICAN tandem Cyl. intercooler
8"x8" SULLIVAN Horiz. Belt dr.
6"x8" BURY Horiz. Belt Dr.
9"x8" BLAISDELL, horiz. belt dr.
4½x4½ CURTISS VERTICAL belt
6"x6" CURTISS TWIN CYL. VERTICAL

BUFFERS OR POLISHING LATHES

HAMMOND like new 10 HP type 10 PP 3-60-220/440 —8 months old

LOSWING LATHE

8"x108" Heavy Duty, Geared Head
4"x104" old model, Geared Head
4"x60" old model, Geared Head
4"x48" old model, Geared Head

THREAD MILLERS

LEES-BRADNER 12"x54"
HALL PLANETARY #2—24" swing

THREAD ROLLERS

WATERBURY-FARRELL #30, #10, #0 (2ea)
EYELETTING PRESSES #158 Waterburys

DIE CASTING MACHINES

MADISON-KIPP #5—10x12 & 12x14 late

RADIAL DRILLS

3' Arm AMERICAN, Geared Box, SPD.
5' Arm Niles, flat col. Motor dr.
5' Arm Niles, flat col. motor dr.

PRESSES

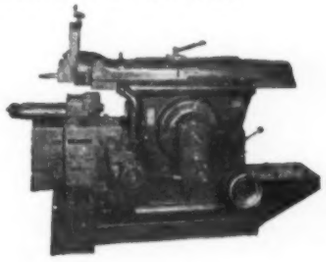
#3½C BLISS TOGGLE also #1-
#93F TOLEDO Dble Cr. Geared
#WFF Dble Cr. S.S. Geared, 70 ton
4" stroke; bed 30x26; 13" die space
#25N, #15N BLISS back flywheel
#2 Bliss Stiles type (10) also #1
#18—18C—#19—#19C—#20—BLISS, GBL
#25 NIAGARA ARCH; #30 Bliss Arch
#16 NIAGARA HORN, Geared, Motor Dr. with Table elev. and swing, 5" st
#44 V & O HORN, Geared; Table 24x24 2½" Str. Motor dr.
WICKES Dble End PUNCH & SHEAR; 48" thro. cap. 1¼ thru 1¼
SOUTHWARK 520 Ton Hydraulic Press; with Lourie Pump, bed 30"x144"

MILLERS

INDEX UNIVERSAL VERTICAL (new)
CLEVELAND #1—cap 2" End mill (new)
BECKER #7 LINCOLN TYPE
MISC. CHICAGO AUTOMATIC THREADERS, BAKER AUTO. DRILLS; SLEEPER & HARTLEY AUTO. COILING MACHINES FOR MAKING SPEEDOMETER CABLE

SHAPERS

15" HENDEY Friction Dr.
20" STEPTOE, Back Geared, cone
20"x20"x24" PLANER-SHAPER; NBP



We try to maintain one of the leading stocks of Used Machinery.

SEND US YOUR INQUIRIES—EVERY ITEM FULLY GUARANTEED.

FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

AUTOMATICS

14"x19" Fay
No. 6A Potter & Johnston
Nos. 33, 34 and 454 New Britain
4½" Gridley model H
6"x6¾" Goss & DeLeeuw
1" Cleveland "J" double end
No. 16 Gisholt simplimatics
10" Bullard "Vert-al-Matic"

BROACHES

Nos. 1, 3 and 4 LaPoint screw
No. 3 LaPoint double screw
No. 2 Standard screw press
2 ton American rack vertical

DRILLS

15", 20", 21" Buffalo
20", 22½" and 26" Barnes
21" and 25" Superior
20", No. 210 Barnes heavy
24" Barnes all geared
20" No. 23 Foote Burt
21" Cincinnati manufacturing
Natco multiple Nos. 11, 12, B12, C12, 14 and 32, 8 to 62 spindles
No. 1 Baush multiple
No. 13 Pratt & Whitney multiple
Nos. 15½D and 15½F Foote Burt manufacturing
No. 4H Natco hydraulic horizontal multiple
Barnes vert. mult. hydr.
8 spindle No. 6 Moline Holehog
Nos. 0 and 00 Garvin duplex
4"x19" Sundstrand centerer
4' Hammond radial
Sensitive drills. Almost all makes and sizes

FORGING & STRUCTURAL

1½" Acme upsetters
2½" and 4" Ajax upsetters
2" National upsetter
No. 1A Ajax forging rolls
No. 4 Torrington swager
No. 6H8 Langelier swager
60 lb. Bradley helve hammer
150 lb. Nazel air hammer.
No. 1 Rock River bulldozer
No. 29 Williams White bulldozer
12", 1½"x1" Cleveland horizontal punch
12", 1¼"x1" Long & Alstatter punch
26", ¾"x¾" Rock River punch

GEAR MACHINERY

Nos. 3 & 12 Barber Colman
No. 18 H Gould & Eberhardt
Nos. 1 & 5A Lees Bradner
26"x48" Brown & Sharpe automatic
30" Flather automatic
36" Gould & Eberhardt automatic
60" Cincinnati automatic
Nos. 6, 61 & 62 Fellows shapers
18" Gleason testers & lappers
15" Gleason spiral gear rougers
Gleason spiral pinion rougher
18" Gleason bevel generator
2 spindle Lipe chamferer
Pratt & Whitney worm grinder
National gear checker

GRINDERS

10x36 & 10x50 Norton
12x36 Landis
12x36 Cincinnati
Capitol internal
Nos. 6 & 15A Bryant internal
12"x36" Diamond surface
20"x50" Safety surface
Nos. 50 & 60 Heald cylinder
18", 24" & 53" Gardner disc
24", No. 84 Gardner opposed disc
17"x36"-48" Norton hydraulic crankshaft
Gisholt tool grinder
24" Ingersoll tub type
30" Ransom elect. snagging
16" Norton snagging
2¼" Wil. & Morman drill
Type 15 Norton lapper
No. 575 Hawes tub polisher
20" & 36 Wet Tool

LATHES, TURRET

28" Steinle, 8" hole
24" Steinle 6¼" hole
22" Steinle, 3-9/16" hole
22" Libby, 4½" hole
2¼x24 & 3"x36" Jones & Lamson
Double spindle Jones & Lamson
14"x6' Lodge & Shipley with turret
No. 2 Acme
No. 2 Southworth
No. 2 Warner & Swasey

LATHES, MFG.

11"x3' South Bend, QCG
13"x20" Seneca Falls "Short Cut"
13"x6' Automatic threading
20"x8'6" Wickes mfg.
Melling camshaft
Melling crankshaft
28"x9' centers Bridgeford axle
34"x36" Lo Swing

MILLS, BORING

3⅞" bar Beeman & Smith horiz.
4-15/16" bar Barrett cylinder boring
36" Niles vert. car wheel borer

MILLING MACHINES

No. 3 Turnmilling for round work
Nos. 1 & 1A Davis & Thompson drum type duplex
48" Oesterlein tilted offset
Nos. 10 & 45 Productomatic
No. 6 Whitney hand
12" Pratt & Whitney automatic
Model AB Becker vertical

PLANERS & SHAPERS

24"x24"x5' Gray
24"x24"x6' Woodward & Powell
29"x29"x6' New Haven
36" Morton draw cut shaper
12" Dill vert. shaper or slotter

PRESSES

No. 5 Bliss Consolidated OBI
No. 5½ Niagara OBI
Nos. P3 & PA3 Ferracute
Nos. 14½ & 41A Toledo hornings
Nos. 6 & 6¼ Wat. Ferrel gap
No. 76 Toledo gap frame
No. 62 Bliss gap frame
No. 38½ Bliss straight side
No. 53 Toledo straight side
No. 8-7 Zeh & Hahnemann S.S.
No. 7 Rockford straight side
No. 4 Massillon straight side
No. 2 Standard screw type
28", No. 71 Swaine dbl. cr.
No. 6A Bliss cam drawing
No. 180 Toledo toggle drawing
No. 796¼ Toledo double crank toggle drawing, 108" bet. upr.
750 ton Baldwin Southwark triple action hydraulic toggle, 142½" between uprights

RIVETERS

Nos. 3A, 4A, 5½B & 7B High Speed
No. 80 Grant
20 ton Allen pneumatic

SHEET METAL TOOLS

4'x3/16" Cincinnati press brake
12'x10 ga. Ohl press brake
4"x3/16" Bay City band roll
No. 352 Toledo band roll
Nos. 1 & 2M Pettingell hammers
⅝"x3' and 5' Shuster wire straightener & cutter
Sleeper & Hartley casing coiler
No. 5 Sleeper & Hartley spring coiler
No. 3 RH Magee Wirer

SHEARS

No. 0-15 Stanley Uni-Shear
No. 225 A Bliss slitter
18" Pels beam
2" Newbold guillotine
1½" Lewis alligator
2" Hilles & Jones alligator

TAPPERS

⅝" National precision nut
Nos. 1 & 2X Garvin
Natco lead screw, 1 & 2 way
1½" National 6 spindle nut

THREADERS

½"x3" Wat. Farrel thread roller
½" Acme double head
¾" Economy
1½" Geometric
2" Landis double
2" Landis pipe & Nipple
2" Rogaco pipe mach.

MILES MACHINERY COMPANY, Saginaw, Michigan

HIGH GRADE MACHINE TOOLS

LATHES

16" x 10' South Bend Gap Type Lathe. Standard Change.
42" x 14' Niles Lathe, Cone Drive.

GRINDERS

#60 Heald Internal, Belt Drive
#14—20" Besley Disc Grinder, Belt Drive.
16" x 72" Landis Self Contained Plain Grinder, M.D. Complete.
#5 Oliver Drill Grinding Machine, M.D.
#50 Heald Internal Cylinder Grinding Machine.

GEAR CUTTERS

#3—36" B & S Automatic Gear Cutter.
#1 Adams Gear Hobber, Belt Drive.
#00 Pfauter Gear Hobbing Machine, M.D.
#1 Schuchardt & Schutte Gear Hobbing Machines.
#18H Gould & Eberhardt Gear Hobbing Machine.
#5-60" B & S Automatic Gear Cutting Machine.
Bilgram Automatic Gear Cutter.

BOLT & PIPE THREADERS

4" Williams Pipe Machine.

SHAPERS & PLANERS

16" Rockford Crank Shaper, Back Geared.
32" x 32" x 18' Gray Planer, 2 Heads.
60" x 42" x 18' Betts Planer, side Head and rail head.

MILLERS

48" x 36" x 8' Niles Bement Pond Planer Type Slab Miller, Adjustable rail, Two vertical Heads, Horiz. rail, M.D.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

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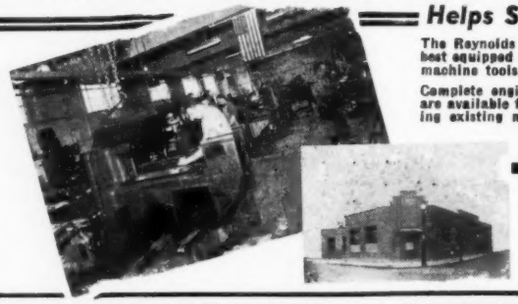
Helps Speed War Production



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Complete engineering and manufacturing facilities are available for modernizing, motorizing and placing existing machine tools in condition for maximum production demands and highest accuracy.

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9/16—16 USF Pratt & Whitney Taps, High Speed; new.

75 HP General Electric Slip Ring Motor; 3 phase; 60 cycle; 440 volt; 645 rpm.

50 HP Fairbanks-Morse Induction Motor; 3 phase; 60 cycle; 440 volts; 514 rpm.

No. 22 New Britain Automatics; 4 spindles; 5 chucking positions; one spindle fixed for tapping; nice condition.

2 Spindle National Acme Bolt Threader; ⅝" capacity; excellent condition.

No. 3 Mitts & Merrill Keyseater; 2" capacity; box of tooling.

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6—Gleason Gear Cutters, 11" and 18" machines
52x20' New Haven Lathe
48" Boring Mill
12—25 KVA Spot Welders
48x8 Planer
500# Board Drop Hammer
1000# Steam Hammer
Cleveland Automatics—⅞", 2¼", 2⅝", single spindle
Arter Grinder, 6x20, cylindrical

Paul's Motor & Machinery Supply Company
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Tyler 76300-02

BEDFORD 42" x 42" x 14' OPEN SIDE PLANER

1 cross head, 1 side head.

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BROACH, No. 2 LaPointe, M.D.
GEAR CUTTERS, Spur, 30", 36" & 40" M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleason, M.D.
GRINDER, Univ., No. 5 B & S, 20" x 72".
GRINDER, 18" x 30" x 96" Norton Cyl., M.D.
LATHE, Driving Wheel, 78" Bement, Dbl. End.
PRESS, Hydr., 1000 ton Wood, platen 42" x 9'.
SLOTTER 15" Dill Table Dia. 34".

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BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED

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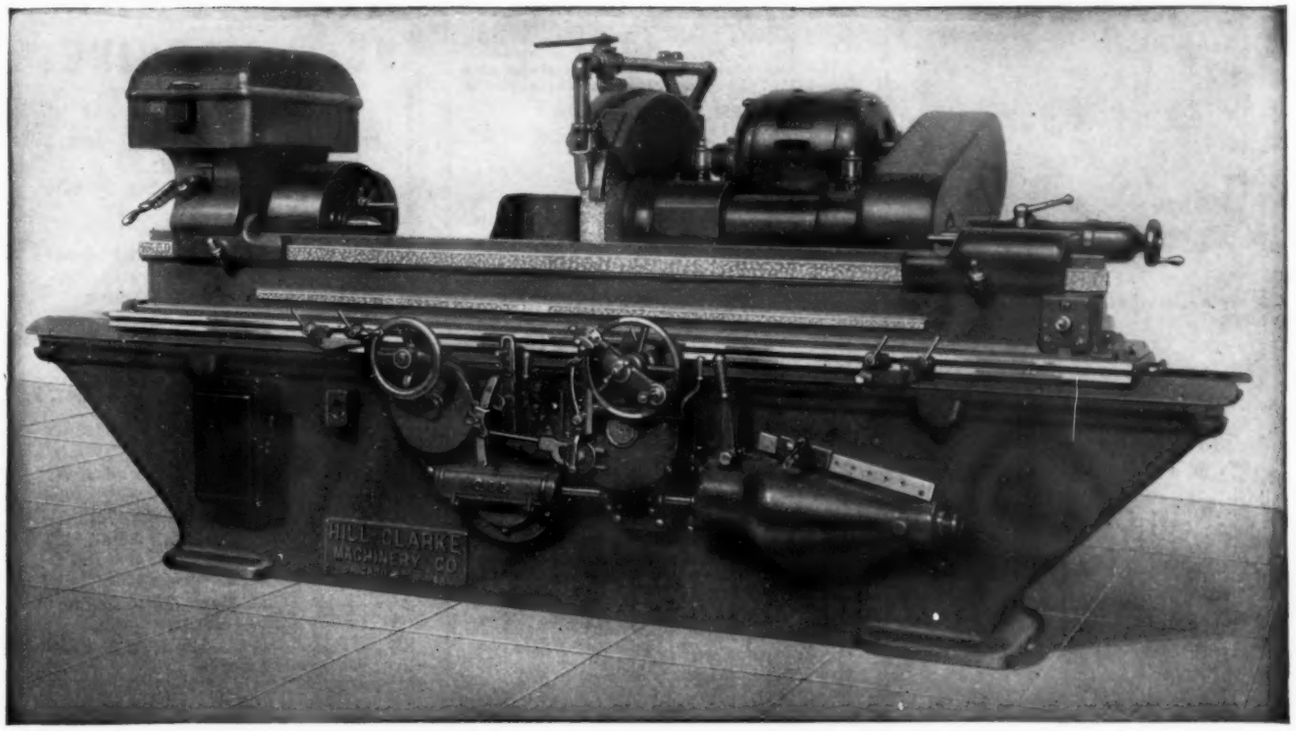
Yours for Super Grinding!



HILL-CLARKE MODERNIZED CYLINDRICAL GRINDERS

give you a finish within a few micro-inches even when using standard grain free-cutting wheels. Contributing to this achievement is a patented multiple V-belt drive from a constant speed motor to the work spindle.

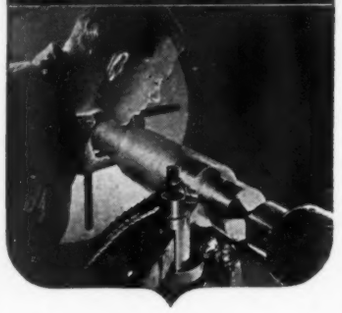
Throughout the machines there are refinements in design, fitting of components, minimized vibration which make possible extreme accuracy in all grinding operations. An accurately fitted wheel slide with cross feed screw mounted in ball bearings provides sensitive wheel control essential to duplicate work within close limits. For complete information, write for our illustrated catalog "Super Grinding."

SIZES			
10 x 36	14 x 36	16 x 50	18-30 x 96
10 x 50	14 x 50	16 x 72	

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BOULEVARD, CHICAGO

KEEP 'EM RUNNING!



Every machine listed in this column is in our warehouse at press time.

MILLING MACHINES

No. 9 N.B.P. Vertical, 32" rotary table.
No. 10 N.B.P. Vertical, 39" rotary table.
30" x 30" x 10' NEWTON Slab Miller

GEAR CUTTERS

24" G&E Spur, M.D.
36" B&S Spur, M.D.
60" B&S Spur, M.D.
50" G&E Spur and Bevel

THREADING MACHINES

2" B&K Pipe, LANDIS Head
2" B&K Motor Drive with motor
4" B&K LANDIS HEAD and cut-off
4" LANDIS with cut-off
6" B&K, cut-off, M.D.
10" STANDARD Pipe, S.P.D.
14" E.C.&B., S.P.D.
¾" GATERMAN Vert. Tapper
4" BAKER Vert. Tapper
16" BAKER Vert. Tapper

PUNCHES AND SHEARS

20" Throat H&J No. 00 ¾" x ⅜"
42" Throat L&A No. 2 1" x 1"
42" Throat H&J No. 2 1" x ⅞"
42" Throat H&J No. 4 1¾" x 1"
54" Throat H&J No. 5 1¾" x 1⅛"
60" Throat L&A No. A 1¾" x 1"
24 Throat L&A Double End ¾" x ¾"
RT 40 SCHULTZ-NAUMAN Beam Shear
6" x 6" x ⅝" Angle Shear
L&A Multiple Punch 6" x 72"
NIAGARA Circle Shear ⅛" x 18"
Washer Press, SOUTHWARK No. 3

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1759 North Broadway, Albany, N. Y.
N. Y. Office: 149 Broadway

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AUTOMATICS
¾" Gridley Model F, four spindle
No. 515 National Acme, four spindle
No. 52 National Acme, four spindle
2⅛" Cleveland Model A, single spindle
2½" Cleveland Model A, single spindle

BROACHES
No. XB10 Oilgear Hydraulic Twin spindle
15 Ton Hercules Verticle

DRILLS
24" Cincinnati, single spindle
No. 17 D Moline Hole Hog, six spindle, No. 5 M.T.
4' Prentice Radial
No. 1½ Foote Burt, 2 spindle
No. 15½ Foote Burt Fixed Center
No. 3B Henry & Wright 3 spindle
No. 37 Natco Multiple Spindle
No. 1 Buasch, 8 spindle
Pratt & Whitney Gun Barrel, 2 spindle, m.d.

GEAR CUTTERS
No. 5 Cincinnati Automatic Gear Cutter
No. 3 Brown & Sharpe Automatic
No. 36 BM Gould & Eberhardt Rougher, three spindle
No. 6 Fellows Gear Shaper
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
18" Gleason Gear Tester
No. 5A Lees-Bradner Gear Generator
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS
No. 2 Cincinnati Centerless
10"x20" Landis Cylindrical hydraulic
18"x96" Brown & Sharpe Cylindrical
8" Heald Rotary Surface
No. 55 Heald Cylinder
No. 60 Heald Cylinder
No. 24—53" Gardner Disc

LATHES
14"x8' Walcott, c.d.
16"x6' LeBlond, c.d.
17"x8' Sidney, c.d.
20"x16' Whitcomb Blaisdel, c.d.
24"x12' Walcott, c.d.
24"x14' Reed Prentice, g.h.

TURRET LATHES
No. 3A Warner & Swasey, g.h.
No. 6A Potter & Johnston, g.h.
3"x36" Jones & Lamson, g.h. bar and chucking

MILLS
No. 1½ Cincinnati Universal, c.d.
No. 5C Becker, Vertical
2½" Cleveland Horizontal Boring, s.p.d.
4" Bement Niles Horizontal Boring
4½"x12" Pratt & Whitney Thread Mill
6"x48" Pratt & Whitney Thread Mill

MISCELLANEOUS
Wicaco Oil Groover
2" Pratt & Whitney Duplex Spline Mill
No. 1 Mitts & Merrill Keyseater
No. 253 Dreis & Krump Press Brake, m.d.
2½" Landis Bolt Cutter, with lead screw

PLANERS AND SHAPERS
54"x54"x16' Niles Bement Pond Planer, 4 heads
36"x36"x12' Niles Double End Planer
16" Gold & Eberhardt Shaper, c.d.
20" Wolcott Shaper, c.d.
24" Cincinnati Shaper, c.d.
24" Gould & Eberhardt

SAWS
6"x6" Peerless Universal Shaping, M.D.
9"x9" Peerless Universal Shaping, M.D.
No. 12 Hicby Cold Cut, 16" blade
48" Ryerson Friction, M.D.

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MOREY
DEPENDABLE
USED MACHINES

BICKFORD 5' Vert. Boring Mill—2 swivel heads—M.D.
La POINTE No. 2 Double Spindle Broach
G. & E. 48" Gear Cutter
WHITON No. 15 Auto. Gear Cutter
FELLOWS No. 6 Gear Shaper
GLEASON 37" Bevel Gear Planer
GLEASON 10" Spiral Bevel Gear Generator
GLEASON 6"-11"-18" Bevel Gear Generators
LANDIS 3½" Internal Hydraulic Race Grinder
NORTON 16"x50" Crankshaft Grinder—M.D.
HEALD No. 60 Internal Grinder
GARDNER No. 6 Dble. End BB Disc Grinder
P. & W. 6"x132" Thread Miller
P. & W. 14"x8' Semi-Quick Change Gear Lathe—M.D.
AUTOMATIC MACHINE CO. 12x4' Threading Lathe
BRIDGEFORD 27"x10' Boring Lathe

NORTON
10x96 Plain Grinder
—Arranged for motor drive, including motors

P. & W. No. 12 Multi-Spindle Drill
NATCO C-13 Hyd. Multiple Spindle Drill
NATCO C-11C Multiple Spindle Drill
CARLTON 3 Radial Drill
ESPEN LUCAS No. 138 Cold Saw—Cap. 12" Rd.
NEWTON No. 197 & No. 200 Cold Saws
COCHRANE & BLY No. 5 Cold Saw
COULTER 2 spindle Diamond Borer—M.D.
LANDIS 4" Single Head Bolt Cutter
ACME 1" All Steel Upsetter
AJAX 3" All Steel Upsetter
SAUNDERS 8"-18" Pipe Threader
TREADWELL 12" Pipe Machine
GISHOLT Precision Balancing Machine
LONG & ALSTATTER Double Angle Shears

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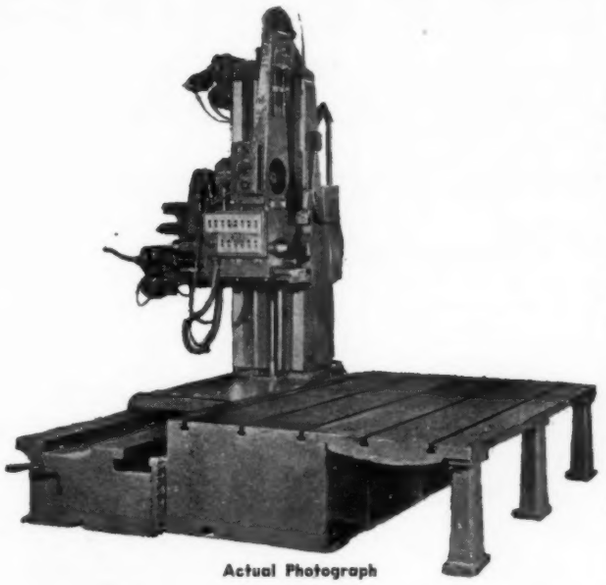
BG-724 KELLER DIE SINKER



Actual Photograph

Die capacity—face 88" x 48"
depth with standard table 30"
depth with extension table 58"
Head vertical travel 48"; horizontal travel 72"
Spindle head travel 18"
Maximum reach of spindle 24"
Center distance between cutter and spindle tracer max. 50½"; min. 35½"
Working surface standard table 88" x 30"
Working surface extension table 88" x 58"
Equipped with panel board and switch boxes
Vertical feed drive motor—¾ HP, 110 volts, vary RPM, Ohio D. C.
Cutter spindle motor—2 HP. 115 volts, Gen. Elec. D.C. motor
Column drive motor—⅝ HP. intermittent duty. 115 volts, G.E. D.C.
Horizontal traverse motor — ⅛ HP. 115 volts. Ohio D.C.
Weight approx. 16,500#

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Your Old Machine Tools

Completely Rebuilt & Modernized for War Production

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OTT MACHINERY SPECIALS

AUTOMATICS, Cleveland, 1-1/16", Model A
AUTOMATICS, Gridley, 2¼, 3¼ & 4¼" S.S.
AUTOMATICS, Cleveland ⅞ & 2½" Model B
AUTOMATICS, #22, 23 & 24 New Britain
GRINDERS, Norton, 10 & 14x36" Plain
LATHE, Putnam, 60"x17' with 12" Risers
MILLING MACHINES, Craftsman # 1, 2 & 3
PLANERS, Bedford & Patch, 36"x13' Open Side with 1 Rail & 1 Side Head
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo #2 to 6 Open Back Inclinable
PRESSES, Ferracute, P2, 3 & 4, Solid Back

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1—No. 1 Garvin Tapper
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1—No. 2—Baxendale Punch Press, M.D.
1—No. 2X Hannifin Air Arbor Press
1—No. 62 Bliss Punch Press, M.D.
1—No. 1A Wm. Sellers Tool Grinder
1—No. 3 Holmes Tilted Tapper
1—Universal Gear Tester
2—Toledo Electric Welders
1—Barr 4 Spindle Drill Press
1—No. 5 Farrell Bull Dozer
1—No. 5 Long & Allstater Punch Press

Your inquiries receive prompt attention

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122-126 Nebraska Ave. **Toledo, Ohio**

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MILLING MACHINES
2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote-Burt Surface Broach
New No. 3 Wigglesworth
No. 2 Knight Vertical
No. 30 Sunstrand Rigid Mill M.D.
TURRET LATHES
Goss & De Leeuw Chucking, 6"x6½".
DRILLS
No. B16 Natco M.D. (2).
No. B13, Natco, M.D.
4 Spindle Taylor & Fenny M.D.
GEAR MACHINERY
6 Cimatool chamfering M.D.
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)
9" Pratt & Whitney Gear Grinder
MISCELLANEOUS
8" Bullard Multimatic M.D.
No. 1 Foote-Burt Duplex Surface Broach
8" Welland Standard Pipe Machine
21'x21"x5' Whitcomb Planer
24x24x8 Whitcomb Planer
No. 303 Bliss St. Side Gd. M.D.
2" Acme Bolt Threader

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1" Cleveland Automatic Screw Machine
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Lathes 9" to 36" swing.
Hand Screw Machines to 2½".
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with direct motor drive 20 H.P. A.C. and Starter
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37 years' experience
"Anything containing IRON or STEEL"

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GEAR CUTTERS & HOBBERS
16" Gould & Eberhardt, belt
Gleason Spiral Bevel Rougher, s.p.d.
No. 1—26" Whiton Full Universal
No. 3—26", 2—36", 3 Heavy, 4—36", 4—48", 6—60", 6—72" Brown & Sharpe Spur
No. 5—14" Lees-Bradner Gear Generator
No. 12 Barber-Colman Gear Hobber
Cross Gear Tooth Rounder, 24" cap.
Ingle Gear Tooth Rounder
18" Gleason Straight Tooth Bevel Gear Generator
18" Gleason Bevel Gear Planer

GRINDERS
14" Pratt & Whitney Model B Vertical Surface, m.d.
Cincinnati Valve Seat Grinder, m.d., centerless type
No. 50, 55, 60, 65 Heald Cylinder
No. 10 Bryant Internal
No. 2 Universal Grinding Machine Co. Universal, belt
No. 1 Fraser Lapper, belt
54" Bridgeport Knife, belt
No. 20 Gardner Combination Disc & Roll, m.d.
Walker Single Stroke Surface, 10" mag. chuck
Gorton Cutter, m.d., late
Gisholt Universal Tool, belt
Gleason Cutter, belt
Gould & Eberhardt Gear Cutter Grinder
Yankee Twist Drill, 1¼" cap.

PLAIN CYLINDRICAL GRINDERS
10x36" Landis Integral Cam, m.d.
10x36" Norton, m.d. (4)
10x50" Norton, m.d.
10x52" Landis, m.d.
10x72" Norton, m.d.
12x36" Cincinnati, belt
12x36" Modern, belt
12x42" Landis, belt
12x48" Modern, m.d.
16x120" Landis, m.d.
26x96" Landis, m.d.

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60 lb. Bradley Rubber Cushioned Helve
100 lb. Little Giant
800 lb. Niles Single Frame Steam
1000 lb. Bement Miles Single Frame Steam
1100 lb. Niles-Bement-Pond Single Frame Steam
2000 lb. Niles-Bement-Pond Single Frame Steam
2500 lb. Bement-Miles Single Frame Steam
Pettengell Bumping, belt

BALL BEARING DRILLS
Automatic Sensitive, m.d.
No. 3 Avey
Foote-Burt Bench Type
Mason Bench Type
No. ⅜ Avey
No. 2 Avey
Henry & Wright Class L
Mason Bench Type
Sigourney Sensitive
6 spindle Henry & Wright
7 spindle Barr

MULTIPLE SPINDLE DRILLS
5 spindle 24" Barnes All Geared Self-Oiling
5 spindle Detroit Horizontal
6 spindle National Acme Horizontal
No. 1 Pratt & Whitney 2 spindle Gun Barrel
No. 008 Garvin Duplex
D2 Fox Multiple Straight Line
No. 2 Baush, hydraulic, m.d.
No. 2 Baush, mechanical, m.d.
No. 3 Baush, 16x30" head
No. 7D Moline 2 spindle Hole Hog
D11 Fox
No. 11 Pratt & Whitney
No. 15HC Fox, hydraulic
No. 26C Fox Tapper, 30 spindles
No. 37 Natco
No. 51C Harrington

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2½' Avey Sensitive
3' Carlton
3' American
4' Hammond Jack Knife
4' Hammond Wall Type
6' Prentice

UPRIGHT DRILLS
10", 20", 22½", 25", 26" W. F. & John Barnes
20" 21" Champion
21", 24" Cincinnati-Bickford
22" Barnes All Geared Self-Oiling
22", 24" Aurora
24" Hoefer
25" Superior

Many other machines in stock.
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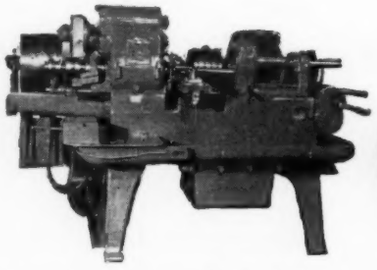
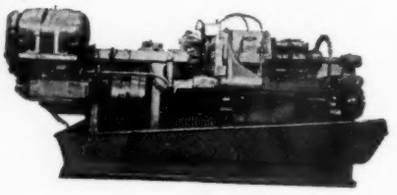
Cleveland single spindle automatic screw machines for *Immediate Delivery*



2—2½" Cleveland Model B
1—4¼" Cleveland Model A



1—1¼" Cleveland Model C
2—2" Cleveland Model B
2—2¼" Cleveland Model B

1—1⅝"x7 New Britain 6-spindle Cutoff Machine

LOUIS E. EMERMAN & CO.
CHICAGO, ILLINOIS

Fifield-Wright Engine Lathe 72" x 46' heavy duty, geared head, electric drive

2—**Le Blond Lathes,** Crankshaft, 20" x 10', electric drive

1—**Landis Cylindrical Grinder** 16" x 52", self cont. electric drive

Williams & White gear cutter 96" complete

1—**Pratt & Whitney, turret lathe** 2½", geared head, g.c., with thread cutting attachment.

Monarch combination turret lathe capacity 1½", 14" swing, electric drive

Potter & Johnston Automatic lathe type 6C, simplimatic electric drive

1—**Gleason** 6", straight **bevel gears**

2—**Bradford Lathes** 24" x 12' and 25" x 9'

1—**Diamond** No. 2, **surface grinder** 16" x 36", electric drive with magnetic chuck, 13" x 36"

1—**Fox** No. 132, **Hydraulic Drill**

4 Way **Multiple Drill Foote-Burt** with electric drive with four motors, heavy type, approximate weight 30,000 lbs.

Double Punch Press Excelsior, electric drive, steel plate, approximate weight 20,000 lbs.

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COMBINATION SURFACE, INTERNAL, LINK & PROFILE MOTOR DRIVEN GRINDER

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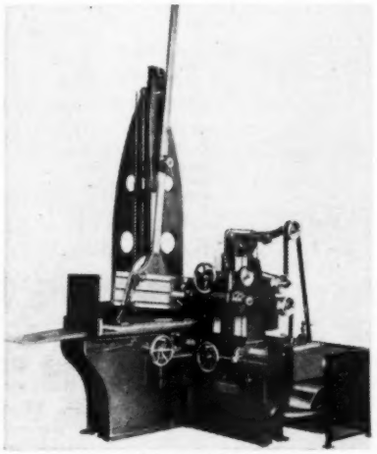


Front view

SPECIFICATIONS

Working surface of vertical table,	12" x 36"
Adjustment of radius,	25" to 107"
Working surface of horiz. table,	16" x 48"
Total height of machine,	12'
Floor space,	83" x 114"

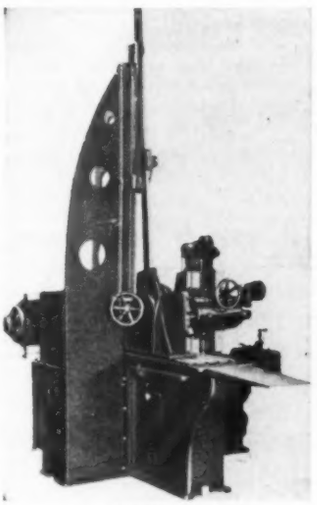
Complete equipment with 7½ H.P. motor to suit customer's electrical requirements.

This unusual machine is guaranteed equal to new.

Shipment, ten days from receipt of order.

Detailed information on request.

Priority not necessary.



Rear view

FRANK TOOMEY MACHINERY CO.

HIGH GRADE MACHINE TOOLS

116 N. Third St. (Walnut 5575.) **Philadelphia, Pa.**

SPECIAL OFFERINGS

2—400 Ton Capacity Hydraulic Presses, 66" x 42" Cold Platens, 7'—5" Vertical Opening, 5200# Hydraulic Working Pressure, 30" Stroke of Ram.

1—400 Ton Capacity, 8 Opening Hydraulic Press, 52" x 30" Steel Steam Platens, 3" per Opening, Complete with Pump, Motor, Valves, Piping, to Make Completee Self-contained Unit.

Headquarters for Hydraulic Pumps, Presses, Accumulators, etc., in Varying Sizes and Capacities.

INDUSTRIAL EQUIPMENT CO.

856 Broad Street **Newark, New Jersey**

500# B & S Board Drop Hammer.
800# B & S Board Drop Hammer.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
36" G & E Gear Cutter.
4' Bickford Radial Drill.
#55 Heald Internal Grinder.
10' Bridgeport Knife Grinder.
20"-24" G & E Shapers.
36" Morton Draw Cut Shaper.
No. 2 Baker Keyseater, 2"x20".

WEST PENN MACHINERY COMPANY

1210 House Bldg. **Pittsburgh, Pa.**

ENGINE LATHE

29" x 20' RAHN-MAYER-CARPENTER S. Q. C. Mounted on raising blocks to swing 39".
36" diameter faceplate with chuck jaws.
26" diameter faceplate, three steady rests.
24" four-jaw fitted independent chuck.

ALSO MANY OTHER TOOLS

ALEX ZEEVE & COMPANY

2269 Woolworth Building **New York, N. Y.**

Your inquiry will have special value . . .

If you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but more important, this proof of active reader interest will demonstrate to the advertiser the usefulness of—and demand for—the vital service rendered by his advertising.

AUTOMATICS, 6" x 6¾" Goss & De Leeuw. #34 New Britain Chucker

GRINDERS, #2 Churchill Internal, can grind 30" deep, dist. center of spin. to top of table 18"; 30" x 240" Landis Cyl.; 24" x 96" Landis Cyl.; 20" x 96" Landis Cyl.; 12" x 72" Landis; 12" x 96" Landis; 12" x 120" Landis; 14" x 96" Cincinnati; No. 25 A Heald 30" rotary. #2 Cincinnati Centerless.

GEAR CUTTERS—11" & 6" Gleason Bevel Gear Generators (4); 36" G & E Spur and Bevel. 48" & 36" Cinci spur (2), 60" Gould & Eberhardt, spur.

KEYSEATERS—#3 Baker, 26" stroke x 3" wide; #6 Catlin 40" stroke x 5" wide; #4 Mitts & M. #1 Davis.

MILLING MACHINES—#3 Lees Bradner Thread Miller; #3 P & W die sinker; #6 Jackson Die Sinker or Vertical Miller; #2 P. & W. Jig Borer; No. 10 NBP vert. 60" diam. table. #4 Cincinnati Vertical, M.D.

PLANERS—72" x 72" x 16' Cincinnati, 2 heads. 1—60" x 60" x 16' Pond, 4 heads, D.C. reversing motor drive, 60" x 48" x 14' Betram Openside 3 hds., DC Reversing M.D. 36"x36"x10' Flather. 2 hds. M.D. 26"x8' Gray, 1 head.

RADIAL DRILLS—7-ft. Amer. univ.; 5-ft. Cinci. Bickford, univ.; 5-ft. NBP univ.; 5-ft. NBP plain; 4 ft. Western Plain, M.D.

ROSENKRANZ MACHINERY CO.

30 Church Street **New York, N. Y.**

MISCELLANEOUS MACHINES

Rockford Sgl. End Hydr. Boring Machine with 2-sta. 54" dia. table.
6' Niles Pl. Radial Drill
No. 60 NATCO 3-Way Multiple Drill
4-Spdl. Henry & Wright H.S. Drill
Niagara Dbl. Seamer, t.&l. pulley dr.
10x10" Napier Metal Band Saw
½" Shuster Auto. Cut.&Straight. Machine

STRONG, CARLISLE & HAMMOND COMPANY

1392 West 3d St., Cleveland, Ohio **2832 E. Grand Blvd., Detroit, Mich.**

BORING MILLS:

42" Colburn Vertical boring mill
48" Niles Bement Ver. boring mill
72" Rogers Vertical boring mill

TURRET LATHES:

2⅛ x24" Jones & Lamson Geared Head
1" Warner & Swasey Hand screw machines (2)

GRINDERS:

14" Pratt & Whitney Vertical surface grinder
#60 Heald Internal grinder
#2 Walker Universal tool & cutter grinder
#3 Modern Cylindrical grinders
Fitchburg cylindrical grinder

DRILLS:

36" Putnam Drill Press
18" American Tool Wks. Combination drilling, milling and boring machine
5' Cincinnati Radial drill

LATHES:

16"x6' Hendey Lathe, Q.C. Taper attach.
22"x10' Hamilton lathe, geared head
28"x12' Schumacher Boye q.c. lathe

SHAPERS:

16" Steptoe

PLANER:

42"x42"x12' Woodward & Powell

MISC:

18" BG Cincinnati Plain milling machine (comparable to #1½)
#0 Brown & Sharpe Forming & Cutting off machine
Acme double spindle bolt threader
Putnam pipe reamer.
#2 Rockford hand Miller

RECONSTRUCTION MACHINE TOOL CORP.

199 Centre St. **New York, N. Y.**

REYNOLDS
MACHINERY CO.

1—2" **Pratt & Whitney Hand Screw Machine**
1—400 lb. **M & G Automatic Drop Hammer**
1—Gleason **Spur Gear Testing Machine**, MD
1—#4-48" **B & S Automatic Gear Cutter**
1—Oliver **Drill Thinner** MD
1—#16 **B & S** 10" x 72" **Cylindrical Grinder**
1—72" **Springfield Knife Grinder**
3—#55 **Cochrane-Bly Cold cut off Saws**
1—**Laidlow Metal Cutting Band Saw** MD
1—#2A **Gale & Sawyer Thread Miller**
1—#10-C **Quick Work Rotary Shear**, 14 gage 48" throat

WE BUY ENTIRE PLANTS

GA spee 5187

211 EDDY ST., PROVIDENCE, R. I.

BRADLEY HAS THE BUYS
IN ALL THESE TYPES OF MACHINE TOOLS

DRILLS
2 spindle Leland Gifford
4 spindle Woodward & Rogers
6 Spindle Allen
Baush Multiple
4—14" Drills
20" Barnes
21" Mechanics Drill
22" Sibley
24" Hoeffer
25" Snyder
28" Weigle

GRINDERS
2—#20 Bryant Internal
Norton double end
#4 Gardner Disc

LATHES
20x10' Perkins LCG
Fitchburg LoSwing
LeBlond Double End
Seneca Falls Lathe
16x6' Monarch Gap

MILLS
Garvin #2 Hand Mill
Porter #500 Vertical
#1 Bristol Hand Mill
Taft Peirce Thread Mill
#3 Burke Bench Mill
#6 Whitney Hand

PLANERS
26x26x8' Ames
Yager Wood Planer

SAWS
2—30" Band Saws
5' Crescent swing saw
10" Circular saw
Toledo Hack saws (new)

SHAPERS
New 8" Shape Rite Shapers

MISCELLANEOUS
#3 Niagara hand shear
#5 Foster Turret lathe
10" Dill slotter
Hancock flame cutting machine
National Acme stud threader
3 ton portable crane
2 ton electric hoist
Waterbury Farrell DSSD Cold header with attachments
Waterbury Farrell bolt trimmer
Williams pipe cutting machine
#1 LaPointe Broach
2—8" Gleason gear generators
#00 Raymond Pulverizer

PRESSES
PG5 Ferrecute
#4 Bliss Punch
#94 Bliss Consolidated Punch
New Famco Arbor Presses
#101 Niagara Punch Press

BRADLEY
MACHINERY COMPANY

211 Jos Campau **Detroit, Mich.**

UNUSUAL VALUES

12"x6' Seneca Falls lathe, loose change gear
3½" x 50" Fitchburg Lo-swing Lathe.
1 Lodge & Davis turret with cross slide turret
Brake: Robinson toggle 5'
#2 Kempsmith Universal Milling Attachment (new)
Drill Presses: 28", 24" Hoefer: 25", 20", 40" Bement
Ceiling Suspended Drill Unlimited drilling area
Grinders: #20 Bryant Internal
Sellers Tool Grinder
300 other machinery items
Rock River ⅞" capacity **punch and shear**
1—3-spindle 1" capacity **Bolt Cutter.**
1—2-spindle #0 **Webster & Perks Threading Machine.** 14" Niles **Traveling Head Shaper**, two tables.
2—½" capacity **Punch and Shears.**
MOTORS—new 5 H.P. for 3-phase, ball brg.

Also rebuilt motors.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

PLANER

1—24" x 24" x 6' Wilson Planer, one head, belt driven.

D. E. DONY MACHINERY CO.
New and Used Machine Tools
47 Laurelton Road **Rochester, N. Y.**

50 lb. **Beaudry Hammer**
40 lb. **William Hammer**
16"x32 **Bridgeport Automatic Threading Lathe**
10"x6" **Higley Power Saw**
24" **Becker Brainard Automatic Gear Cutter** for spur and bevel
Fisher Profile Grinder

INDUSTRIAL MACHINERY COMPANY
357 Dublin, Columbus, Ohio **Adams 3534**

Prompt ANSWERS to your business problems . . .

MISCELLANEOUS business problems are daily being solved, quickly and easily, by the use of the Searchlight Section of this and other McGraw-Hill publications.

The Searchlight Section is classified advertising; you can use it at small cost, to announce all kinds of business wants of interest to other men in the fields served by these publications. It has long been the accepted meeting place of men with business needs and the men who can fill those needs.

When you want additional employees or a position, want to buy or sell used or surplus new equipment, want products to manufacture, seek new capital or factory sites or have other business wants—advertise them in the Searchlight Section for quick profitable results.

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McGRAW-HILL PUBLISHING CO., Inc.
330 West 42nd Street • New York City

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Electrical Contracting
Electrical Merchandising
Electrical World
Electronics
Engineering & Mining Journal
Engineering News-Record
E. & M. J. Markets
Factory Management & Maintenance
Food Industries
Power
Product Engineering
Textile World
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USED MACHINE TOOLS
GUARANTEED BY
A TIME TESTED, RELIABLE COMPANY

DRILLS
- 1 spdl. Henry & Wright
- 1 spdl. Leland-Gifford
- 2 spdl. Leland-Gifford Bench
- 2 spdl. Henry & Wright
- 4 spdl. Henry & Wright
- 4 spdl. Sigourney
- 6 spdl. Woodward & Rogers

GEAR CUTTERS
- No. 60 BM Gould & Eberhardt Bevel Gear Rougher (2)

GRINDERS
- (See page 169—special advertisement Hill-Clarke Cylindrical Grinders)
- 22"x96" Norton Plain, M.D., Roll Forming Attachment
- No. 40 Bryant Plunge Cut, Wide Wheel, Oscillating
- No. 10 Lees-Bradner Spur Gear Grinder
- 1½" dia. New Yankee Drill Grinder

LATHES
- No. 4 AC LeBlond Auto. Duplex Crankshaft

SLOTTERS
- 18" Newton

TAPPERS
- No. 4 Gaterman Tapper, 5/16" Cap.

HILL-CLARKE MACHINERY CO.
651 W. WASHINGTON BLVD. **CHICAGO**

LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of American Machinist, published every other Wednesday at Albany, N. Y., for October 1, 1942.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. A. Gerardi, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of American Machinist, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Editor, Burnham Finney, 330 West 42nd St., N. Y. C. Managing Editor, John Haydock, 330 West 42nd St., N. Y. C. Business Manager, W. E. Kennedy, 330 West 42nd St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder, the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42nd St., N. Y. C. James H. McGraw, Jr., 330 West 42nd St., N. Y. C. James H. McGraw, James H. McGraw, Jr., and Curtis W. McGraw. Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw, 330 West 42nd St., N. Y. C. Curtis W. McGraw, 330 West 42nd St., N. Y. C. Donald C. McGraw, 330 West 42nd St., N. Y. C. Anne Hugus Britton, 330 West 42nd St., N. Y. C. Mildred W. McGraw, Madison, N. J. Grace W. Mehren, 73 No. Country Club Drive, Phoenix, Ariz. J. Malcolm Muir & Guaranty Trust Co. of New York, Trustees for Lida Kelly Muir, 140 Broadway, N. Y. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is. (This information is required from daily publications only.)

J. A. GERARDI, Secretary.

McGRAW-HILL PUBLISHING COMPANY, INC.

Sworn to and subscribed before me this 29th day of September, 1942.

[SEAL] CHESTER W. DIBBLE.

Notary Public, Queens County. Queens County Clerk's No. 4166. Certificate filed in N. Y. Co. Clerk's No. 889.

(My commission expires March 30, 1943)

NEW "SEARCHLIGHT" ADVERTISEMENTS

received by October 19th, will appear in the October 29th issue, subject to limitations of space available.

Address copy to the Departmental Staff

AMERICAN MACHINIST
330 West 42d St., New York City

MODERN TOOLS
Immediate Delivery

LATHES
Davis 16" x 8' Q. C. M. D.
LeBlond 21" x 10' G. H. Crankshaft
Prentice 22" x 12'

TURRET LATHES
Gisholt 24"—2" thru Spindle
Gisholt 5¾" thru Spindle

GEAR CUTTERS
26" Brown & Sharpe
36" Fellows
G. E. 3x36 Spur

AUTOMATICS
2—Gridleys 4 Spindle ⅞" Capacity
1—National Acme, M. D. #55
2—New Britains 4 Spindle 1" x 5"
Cleveland 4 Spindle ⅞" Capacity M. D.
2—#53 National Acme 1", 4 Spindle
2—#74 National Acme 1½", 4 Spindle

MILLERS
#1½ American Horizontal
#3 Les Bredner Thread Miller

GRINDERS
Modern 16" x 60" M. D. Blocks up to 22"
Pratt & Whitney 12" x 24 M. D.

SHAPERS
16" Barker
16" Ohio
20" G & E M.D.

RADIAL DRILLS
6' Prentice Geared Box M. D.
4' Niles, M. D.
4' Bickford
1—Foote Burt Heavy Duty Drill

BORING MILLS—VERTICAL
40" Bickford Boring Mill—Single Turret, head on rail.
36" Car Wheel Boring Mill

BORING MILLS—HORIZONTAL
4" Single Pulley Driven Bickford
2" Binsee

MISCELLANEOUS
40" x 40" x 12' New Haven Planer, 2 heads on rail with 1 side head.
36" Throat Heavy Duty Punch, M. D.
1000 lb. Chambersburg Steam or Air Hammer, Single frame.
10" & 12" Slotters—Newton
25 Ton Bedford Crane—50' Span
16" Beasley Ball Bearing Grinder
3—Form Rolling Machines (5 sets of Form Rollers)

This is only a partial list
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Contact us for rebuilt machinery

S. & S. MACHINERY CO.
207 CENTRE STREET
NEW YORK, N. Y.
WOrth 4-5710

FOR SALE
1—6" Bilgram Bevel Gear Generator with countershaft
1—Sundstrand Centering Machine, motorized
1—25-HP ballbearing Crocker-Wheeler Motor
1—40-HP ballbearing Crocker-Wheeler Motor
2—Ingersoll-Rand Motorized Compressors

Sier-Bath Gear Co., Inc.
9252 Hudson Boulevard,
NORTH BERGEN, N. J.

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ABRASIVE GRAIN & STONES (See GRAINS, Abrasive)

ABRASIVE PAPERS & CLOTH (See PAPER & CLOTH, Abrasive)

ALLOYS, Aluminum (See ALUMINUM)

ALLOYS, Copper
American Brass Co., Waterbury, Conn.
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Revere Copper & Brass Inc., N. Y. C.

ALLOYS, Corrosion & Heat Resistant
Allegheny-Ludlum Steel Corp., Pittsburgh
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Bunting Brass & Bronze Co., Toledo, O.
Carboloy Co., Detroit
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Dow Chemical Co., Midland, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes-Stellite Co., N. Y. C.
Latrobe Electric Steel Co., Latrobe, Pa.
Mallory & Co., Inc., P. R., Indianapolis
Republic Steel Corp., Cleveland
Revere Copper & Brass, Inc., N. Y. C.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube Div., Canton, O.

ALLOYS, Magnesium
American Magnesium Co., Pittsburgh
Dow Chemical Co., Midland, Mich.

ALLOYS, Special Iron
American Brake Shoe & Fdry. Co., N. Y. C.
Meehanite Research Institute, Pittsburgh

ALLOYS, Steel
Allegheny-Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div., Newcastle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Electric Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O.
United States Steel Corp., Pittsburgh
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

ALUMINUM
Aluminum Co. of America, Pittsburgh

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Revere Copper & Brass, Inc., N. Y. C.

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Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Cleveland Twist Drill Co., Cleveland
Cushman Chuck Co., Hartford, Conn.
Disston & Sons, Inc., Henry, Philadelphia
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Gisholt Machine Co., Madison, Wis.
Gleason Works, Rochester, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee
Latrobe Electric Steel Co., Latrobe, Pa.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland, O.
National Twist Drill & Tool Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pratt & Whitney Div., Niles-Rement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Warner & Swasey Co., Cleveland

ATTACHMENTS, Broaching Machine
Colonial Broach Co., Detroit

ATTACHMENTS, Grinding Machine
Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Tool Co., Waynesboro, Pa.
Liberty Tool & Gage Wks., Providence, R. I.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

LUCAS "PRECISION"
Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.
NOW AND ALWAYS OF
CLEVELAND
OHIO, U. S. A.

ATOMETRIC GAGE BLOCKS
ACCURACY

PERFECTION IN MEASUREMENT
MEANS
PERFECTION IN YOUR PRODUCT
ATOMETRIC PRECISION GAGE LABORATORIES, Inc.
STAMFORD, CONNECTICUT, U. S. A.

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Ames Co., B. C., Waltham, Mass
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Dumore Co., Racine, Wis.
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
Jefferson Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Monarch Machine Tool Co., Sidney, O.
Pratt & Whitney Div., Niles-Bemont-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Rockford Mach. Tool Co., Rockford, Ill.
South Bend Lathe Wks., So. Bend, Ind.
Strand Co., N. A., Chicago
Warner & Swasey Co., Cleveland

ATTACHMENTS, Milling
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Auto Ordnance Corp., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Fray Machine Tool Co., Glendale, Calif.
Jefferson Mach. Tool Co., Cincinnati
Lempco Products, Inc., Bedford, O.
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
National Machine Tool Co., Cincinnati
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
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Sellers & Co., Inc., Wm., Philadelphia

ATTACHMENTS, Screw-Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Empire Tool Co., Detroit
Meisel Press Mfg. Co., Boston

ATTACHMENTS, Tapping
Avey Drilling Mach. Co., Cincinnati
Barber-Colman Co., Rockford, Ill.
Errington Mech. Lab., Stapleton, N. Y.
Greenlee Bros. & Co., Rockford, Ill.
Haskins Co., R. G., Chicago
Kingsbury Mach. Tool Corp., Keene, N. H.
Moline Tool Co., Moline, Ill.
Murchey Machine & Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.

BABBITT (See METALS, Bearing)

BALANCING MACHINES
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Federal Bearings Co., Poughkeepsie, N. Y.
SKF Industries, Inc., Philadelphia
Waterbury Steel Ball Co., Poughkeepsie, N. Y.

BARRELS, Tumbling & Burnishing
Waterbury Steel Ball Co., Poughkeepsie, N. Y.

BARS, Boring
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit
Elmes Engrg. Wks., Chas. F., Chicago
Fray Machine Tool Co., Glendale, Cal.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
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Scully-Jones & Co., Chicago
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Universal Boring Mach. Co., Hudson, Mass.
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Carlyle Johnson Machine Co., Manchester, Conn.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Babbitt
Bunting Brass & Bronze Co., Toledo, O.
Phosphor Bronze Smelting Co., Philadelphia

BEARINGS, Ball
Bantam Bearings Corp., So. Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Poughkeepsie, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Schatz Mfg. Co., Poughkeepsie, N. Y.
Torrington Co., Torrington, Conn.

BEARINGS, Needle & Quill
Bantam Bearings Corp., So. Bend, Ind.
Federal Bearings Co., Poughkeepsie, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of Amer., Trenton, N. J.
S. K. F. Industries, Inc., Philadelphia
Torrington Co., Torrington, Conn.

BEARINGS, Non-Metallic
Bakelite Corp., N. Y. C.

BEARINGS, Oilless & Graphite
Bunting Brass & Bronze Co., Toledo, O.
Carlyle Johnson Machine Co., Manchester, Conn.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Roller
Bantam Bearings Corp., So. Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of Amer., Trenton, N. J.
S. K. F. Industries, Inc., Philadelphia
Timken Roller Bearing Co., Canton, O.

BEARINGS, Thrust
(See preceding classifications)

BELLOWS, Seamless Metal
Chicago Metal Hose Corp., Maywood, Ill.

BELTING, Leather
Greene, Tweed & Co., N. Y. C.
Houghton & Co., E. F. Philadelphia

BELTING, Rubber & Fabric
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Col.

BELTS & BANDS, Abrasive
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Dumore Co., Racine, Wis.
Mid-West Abrasive Co., Detroit
Norton Company, Worcester, Mass.
Pratt & Whitney Div., Niles-Rement-Pond Co., Hartford, Conn.
Walls Sales Corp., N. Y. C.

BELTS "V"
Allis-Chalmers Mfg. Co., Milwaukee
Dayton Rubber Mfg. Co., Dayton O.
Gates Rubber Co., Denver, Col.

BENCHES, Shop
Baumbach Mfg. Co., E. A., Chicago
Delta Mfg. Co., Milwaukee
Hardinge Brothers, Inc., Elmira, N. Y.
Hill Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Boston
Standard Pressed Steel Co., Jenkintown, Pa.
Walker-Turner Co., Plainfield, N. J.

BENDERS, Hand
O'Neil-Irwin Mfg. Co., Minneapolis

BENDING & STRAIGHTENING Machines
Ajax Mfg. Co., Cleveland
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Wks., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.

WHERE-TO-BUY DIRECTORY

Elmes Engrg. Works, Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

BINS, Tool & Parts (See LOCKERS & SHELVING)

BITS, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carboloy Co., Detroit
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Crafts Co., Inc., Arthur A. Boston
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Latrobe Electric Steel Co., Latrobe, Pa.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Union Twist Drill Co., Athol, Mass.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

BLADES, Circular-Saw (See SAW BLADES, Circular)

BLADES, Cutter, Milling, Boring & Reaming (See BITS, Tool)

BLADES, Hack- & Band-Saw
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C. Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Clemson Bros., Inc., Middletown, N. Y.
Continental Machines, Inc., Minneapolis
Disston & Sons, Inc., Henry, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Starrett Co., L. S., Athol, Mass.
Thompson & Sons Co., Henry G., New Haven, Conn.
Victor Saw Works, Middletown, N. Y.

BLOCKS, Pillow
Allis-Chalmers Mfg. Co., Milwaukee
Earle Gear & Mach. Co., Philadelphia
Fafnir Bearing Co., New Britain, Conn.
Farrel-Birmingham Co., Ansonia, Conn.
Hill Acme Co., Cleveland
Norma-Hoffmann Bearnigs Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Standard Pressed Steel Co., Jenkintown, Pa.

BLOCKS, Precision Gage
Atometric Precision Gage Laboratories, Inc., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Jansson Gage Co., Detroit
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Webber Gage Co., Cleveland

BLOCKS, "V"
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BLOWERS
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J.
Buffalo Forge Co., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Wagner Electric Corp., St. Louis

BLOWERS, Electric Hand
Buffalo Forge Co., Buffalo, N. Y.
Skilsaw, Inc., Chicago

BLUING, Layout
Dykem Co., St. Louis

BOLT & NUT MACHINES
Ajax Mfg. Co., Cleveland
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Consolidated Machine Tool Corp., Rochester, N. Y.
Eastern Machine Screw Corp., New Haven, Conn.
Federal Press Co., Elkhart, Ind.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haskins Co., R. G. Chicago
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Scherr Co., Geo., N. Y. C.
Taft-Peirce Mfg. Co., Woonsocket, R. I
V. & O. Press Co, Hudson, N. Y.

BOLTS, Eye & T-Slot
American Chain & Cable Co., Bridgeport, Conn.
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

BOLTS & NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Union, N. J.
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.

BORING, DRILLING & MILLING MACHINES, Horizontal
Atlantic Machinery Co., N. Y. C.
Avey Drilling Mach. Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bryant Machinery & Engrg Co., Chicago
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cincinnati Gilbert Mach. Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Defiance Mach. Wks., Inc., Defiance, Ohio
Foote-Burt Co., Cleveland
General Machy. Corp., Hamilton, O.
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland
National Auto Tool Co., Richmond, Ind.
Ohio Machine Tool Co., Kenton, O.
Sheffield Corp., Dayton, O.
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Springfield Mach. Tool Co., Springfield, O.
Universal Boring Mach. Co., Hudson, Mass.
Yoder Co., Cleveland

BORING MACHINES, Jig (See JIG-BORING MACHINES)

BORING MACHINES, Precision
Barnes Co., W. F. & John, Rockford, Ill.
Bryant Machinery & Engrg. Co., Chicago
Ex-Cell-O Corp., Detroit
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Heald Machine Co., Worchester, Mass.
Leland-Gifford Co., Worcester, Mass.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
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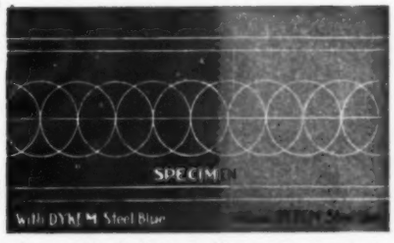

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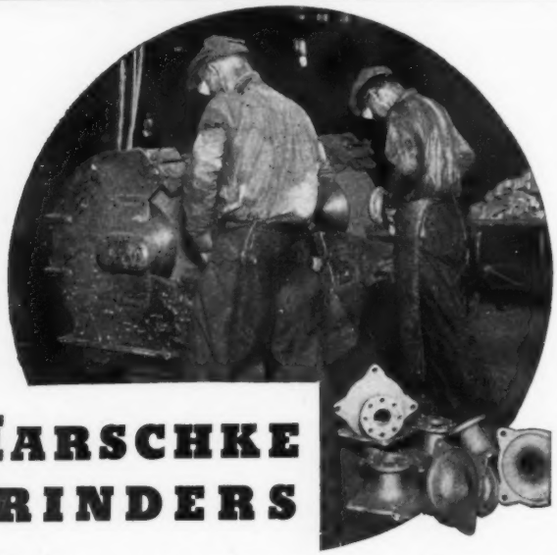

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King Machine Tool Co., Cincinnati
Sellers & Co., Inc., Wm. Philadelphia
Springfield Mach. Tool Co., Springfield, O.

BOXES, Tote
American Metal Works, Inc., Philadelphia, Pa.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

BRAKES, Bending, Power
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Wks. Co., Cleveland

BRAKES, Electric
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

BRICK, Furnace (See REFRACTORIES)

BROACHES
American Broach & Machine Co., Ann Arbor, Mich.
Butterfield & Co., Derby Line, Vt.
Colonial Broach Co., Detroit
Dalzen Tool & Mfg. Co., Detroit
Detroit Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
East Shore Mach. Pdts. Co., Cleveland
Ex-Cell-O Corp., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

BROACHING MACHINES
American Broach & Machine Co., Ann Arbor, Mich.
Cincinnati Milling Mach. Co., Cincinnati
Colonial Broach Co., Detroit
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg Works, Chas. F., Chicago
Foote-Burt Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Thompson Grinder Co., Springfield, O.

BRONZE, Phosphor (See PHOSPHOR BRONZE)

BUFFERS & POLISHERS
Black & Decker Mfg. Co., Towson, Md.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Heald Machine Co., Worcester, Mass.
Hill-Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Landis Tool Co., Waynesboro, Pa.
Mattison Machine Works, Rockford, Ill.
New Britain-Gridley Mach. Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker-Turner Co., Plainfield, N. J.

BUFFERS & POLISHERS, Hand
Behr-Manning Corp., Troy, N. Y.
Roberts Rubber Co., Weldon, Newark, N. J.

BULLDOZERS
Ajax Mfg. Co., Cleveland
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Elmes Eng. Works, Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Watson-Stillman Co., Roselle, N. J.

BURNERS, Gas & Oil Furnace
American Gas Furn. Co., Elizabeth, N. J.
Hones, Inc., Charles A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

BURNISHERS, Gear
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

BURNISHING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
Sheffield Corp., Dayton, O.

BURRING MACHINES
Ajax Mfg. Co., Euclid, Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Hill Acme Co., Cleveland
National Broach & Machine Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

BUSHINGS, Drill
Carboloy Co., Detroit
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Metal Carbides Corp., Youngstown, O.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Steel (See LOCKERS & SHELVING)

CALCULATORS, Electric
Marchant Calculating Machine Co., Oakland, Calif.

CALIPERS & COMPASSES
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Ansonia, Conn.
Lufkin Rule Co., Saginaw, Mich.
Randall & Stickney, Waltham, Mass.
Scherr Co., Geo., N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS, Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Cross Gear & Machine Co., Detroit
Hartford Special Machinery Co., Hartford, Conn.
Weldon Tool Co., Cleveland

CARBURIZERS (See also BOXES, Heat-Treating & Annealing)
American Gas Furn. Co., Elizabeth, N. J.
Houghton & Co., E. F., Philadelphia
Surface Combustion Corp., Toledo, O.

CARTRIDGE-CASE FINISHING MACHINES
Coulter Mach. Co., Jas., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CASTINGS
American Brake Shoe & Fdry. Co., N. Y. C.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bunting Brass & Bronze Co., Toledo
Etna Machine Co., Toledo, O.
Hill Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Johnson Bronze Co., New Castle, Pa.
Mattison Machine Wks., Rockford, Ill.
Springfield Mach. Tool Co., Springfield, O.

CEMENT, Belt
Desmond-Stephan Mfg. Co., Urbana, O.
Houghton & Co., E. F., Philadelphia

CEMENT, Refractory
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

CENTERING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Hanson-Whitney Machine Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.

WHERE-TO-BUY DIRECTORY

Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Co., Rockford, Ill.

CENTERS, Bench
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Providence, R. I.

CENTERS, Machine
Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
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Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati
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Haynes Stellite Co., N. Y. C.
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McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.

CENTRIFUGALS (See PURIFIERS, Oil & Coolant)

CENTRIFUGAL MACHINERY
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

CHAIN, Forged-Steel Link
American Chain & Cable Co., Bridgeport, Conn.
Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
McKay Co., Pittsburgh
Scully Steel Products Co., Chicago

CHAINS, Conveyor
Allis-Chalmers Mfg. Co., Milwaukee
American Chain & Cable Co., Bridgeport, Conn.

CHAINS, Transmission
Bilgram Gear & Mach. Wks., Philadelphia
Cincinnati Gear Co., Cincinnati
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland

CHAMFERING MACHINES
Bilgram Gear & Mach. Wks., Philadelphia
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Lipe-Rollway Corp., Syracuse, N. Y.
Murchey Machine & Tool Co., Detroit
National Broach & Mach. Co., Detroit
Sheffield Corp., Dayton, O.

CHECKS, Metal, Time and Tool
Acromark Co., Elizabeth, N. J.
Noble & Westbrook Mfg. Co., East Hartford, Conn.
Revere Copper & Brass Inc., N. Y. C.

CHISELS, Hand (See TOOLS, Hand)

CHISELS, Chipping, Pneumatic & Electric Hammer
Bethlehem Steel Co., Bethlehem, Pa.
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneumatic Tool Co., Cleveland
Plomb Tool Co., Los Angeles, Calif.
Scully-Jones & Co., Chicago

CHUCKING MACHINES (See also LATHES, Automatic & Semi-Automatic)
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Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Gorton Mach. Co., George, Racine, Wis.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lees-Bradner Co., Cleveland
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

CHUCKS, Air (See CHUCKS, Pneumatic)

CHUCKS, Collet (See Collets)

CHUCKS, Drill & Tap
Atlas Press Co., Kalamazoo, Mich.
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Gisholt Machine Co., Madison, Wis.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
North Bros. Mfg. Co., Philadelphia
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland

CHUCKS, Drill, Quick-Change, Collet
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Scully-Jones & Co., Chicago

CHUCKS, Gear
Cushman Chuck Co., Hartford, Conn.
Gleason Works, Rochester, N. Y.
Sheffield Corp., Dayton, O.

CHUCKS, Hydraulic
Cross Gear & Machine Co., Detroit
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
New Britain-Gridley Machine Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Lathe
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Cushman Chuck Co., Hartford, Conn.
Delta Mfg. Co., Milwaukee
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Harnischfeger Corp., Milwaukee
Hendey Machine Co., Torrington, Conn.
L-W Chuck Co., Toledo, O.
McCrosky Tool Corp., Meadville, Pa.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scherr Co., Geo., N. Y. C.
Tomkins-Johnson Co., Jackson, Mich.

CHUCKS, Magnetic
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

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Goss & deLeeuw Machine Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Pneumatic
Cushman Chuck Co., Hartford, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Ring-Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Gardner Machine Co., Beloit, Wis.

CHUCKS, Spring
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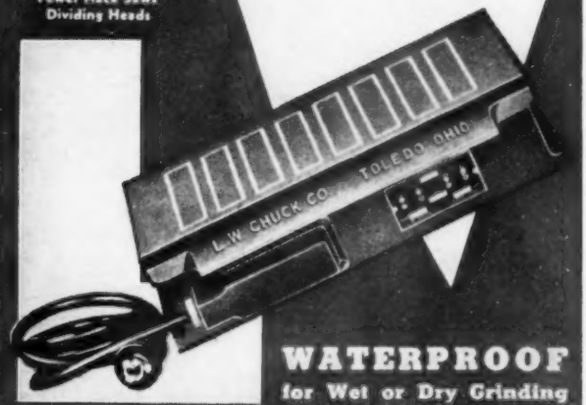

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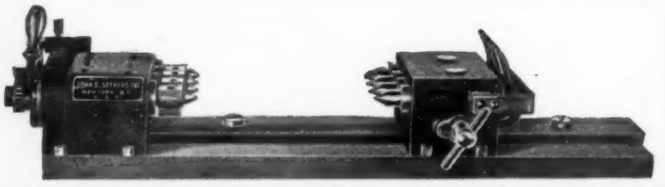

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Weatherhead Co., Cleveland

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Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

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Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

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Scully-Jones & Co., Chicago

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Michigan Tool Co., Detroit
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National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
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Cleveland Twist Drill Co., Cleveland
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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Weldon Tool Co., Cleveland

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National Twist Drill & Tool Co., Detroit
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Producto Machine Co., Bridgeport, Conn.
Scherr Co., Geo., N. Y. C.
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Stow Mfg. Co., Binghamton, N. Y.
Taylor Machine Co., Cleveland
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Waltham Mach. Wks., Waltham, Mass.

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Michigan Tool Co., Detroit
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Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Machine Tool Co., Cincinnati
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

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Cleveland Twist Drill Co., Cleveland
Crafts Co., Inc., Arthur A., Boston
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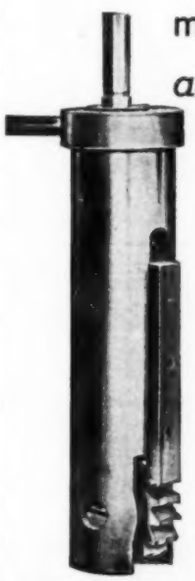

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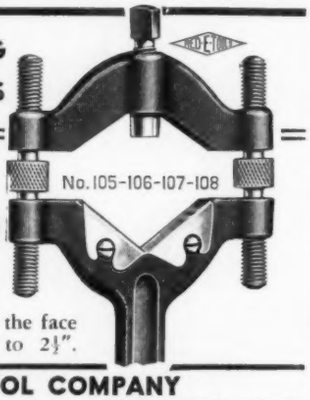

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Michigan Tool Co., Detroit
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Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
O. K. Tool Co., Shelton, Conn.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
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Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
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Greenfield Tap and Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., Cleveland

DIE-MAKERS' SUPPLIES
Baumbach Mfg. Co., E. A., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., Detroit
Danly Mach. Specialties, Inc., Chicago
Dykem Co., St. Louis
Lufkin Rule Co., Saginaw, Mich.
Masonite Corp., Chicago
Producto Mach. Co., Bridgeport, Conn.
Starrett Co., L. S., Athol, Mass.

DIE-MAKING & CUTTING MACHINES
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Gorton Machine Co., Geo., Racine, Wis.
Henry & Wright Mfg. Co., Hartford, Conn.
Illinois Tool Works, Chicago
Johnson Tool Co., E. Providence, R. I.
Peerless Machine Co., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.

DIE-SETS
Baumbach Mfg. Co., E. A., Chicago
Card Mfg. Co., S. W., Mansfield, Mass.
Danly Mach. Specialties, Inc., Chicago
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DIE-SINKING MACHINES
Cincinnati Milling Mach. Co., Cincinnati
Gorton Machine Co., Geo., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.

DIES, Marking & Embossing
Acromark Co., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., East Hartford, Conn.

DIES, Screw-Cutting, Adjustable
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Eastern Machine Screw Corp., New Haven, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Sheet-Metal & Forging
Hamilton Tool Co., Hamilton, O.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

DIES, Solid Bolt & Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Consolidated Machine Tool Corp., Rochester, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Warner & Swasey Co., Cleveland

DIES, Sub-Press
Baumbach Mfg. Co., E. A., Chicago
Danly Mach. Specialties, Inc., Chicago
Producto Machine Co., Bridgeport, Conn.
V & O Press Co., Hudson, N. Y.
Waltham Mach. Works, Waltham, Mass.

DIES, Wire-Drawing & Extrusion
Carboloy Co., Inc., Detroit
Crafts Co., Arthur A., Boston
Firth-Sterling Steel Co., McKeesport, Pa.
Illinois Tool Works, Chicago
Metal Carbides Corp., Youngstown, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.

DISKS, Abrasive (See WHEELS, Grinding & Polishing)

DISKS, Circular Cutting
Atkins & Co., E. C., Indianapolis
Disston & Sons, Inc., Henry, Philadelphia
Morse Twist Drill and Machine Co., New Bedford, Mass.

DIVIDERS (See CALIPERS & COMPASSES)

WHERE-TO-BUY DIRECTORY

DOGS, Lathe & Milling-Machine
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Hendey Machine Co., Torrington, Conn.
LeBlond Mach. Tool Co., R. K., Cincinnati
Ready Tool Co., Bridgeport, Conn.
Sturdimatic Tool Co., Detroit
Williams & Co., J. H., Buffalo, N. Y.

DRESSERS, Grinding Wheel
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins & Co., E. C., Indianapolis
Black & Decker Mfg. Co., Towson, Md.
Carboloy Co., Inc., Detroit
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Disston & Sons, Inc., Henry, Philadelphia
Dumore Co., Racine, Wis.
Metal Carbides Corp., Youngstown, O.
Norton Co., Worcester, Mass.
Schultz & Anderson Co., Newark (Radius)
Smit & Sons, J. K., N. Y. C.
Standard Tool Co., Cleveland
Victor Machinery Exchange, N. Y. C.

DRESSING, Belt
Houghton & Co., E. F., Philadelphia
Tide Water Associated Oil Co., N. Y. C.
White & Bagley, Worcester, Mass.

DRIERS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

DRIFTS, Drill
Armstrong Bros. Tool Co., Chicago
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Standard Tool Co., Cleveland

DRILLROD, Steel Tool (See **STEEL, Tool**)

DRILLS, Automatic & Semi-Automatic
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear and Machine Co., Detroit
Davis & Thompson Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.

DRILLS, Bench
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Ryerson & Son, Jos. T., Chicago
Schauer Mach. Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

DRILLS, Breast (See **TOOLS, Hand**)

DRILLS, Center
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill and Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRILLS, Column-Type
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Dalzen Tool & Mfg. Co., Detroit
Davis & Thompson Co., Milwaukee
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., Detroit

DRILLS, Core
Carboloy Co., Inc., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Wendt Sonis Co., Hannibal, Mo.

DRILLS, Flat (See **DRILLS, Twist & Flat**)

DRILLS, Hand (See **TOOLS, Hand**)

DRILLS, Horizontal
Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, Ohio.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bradford Machine Tool Co., Cincinnati
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Machine and Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.
Ryerson & Son, Jos. T., Chicago
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Universal Boring Mach. Co., Hudson, Mass.

DRILLS, Deep-Hole
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DRILLS, Multi-Spindle or Gang
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
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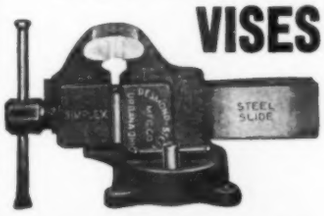

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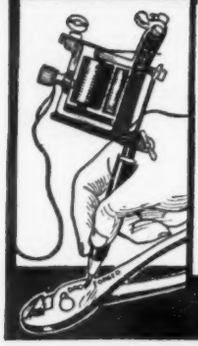

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Scherr Co., Geo., N. Y. C.
Snyder Tool & Engrg. Co., Detroit

DRILLS, Portable Electric (See **TOOLS, Portable Electric**)

DRILLS, Portable Pneumatic (See **TOOLS, Portable Pneumatic**)

DRILLS, Radial
American Tool Works Co., Cincinnati
Bryant Machinery & Engrg. Co., Chicago
Carlton Machine Tool Co., Cincinnati
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Mach. Tool Co., Cincinnati
Cleveland Punch & Shear Works, Inc., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Morris Machine Tool Co., Cincinnati

DRILLS, Sensitive
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
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Dalzen Tool & Mfg. Co., Detroit
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
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Leland-Gifford Co., Worcester, Mass.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Geo., N. Y. C.
Walker-Turner Co., Inc., Plainfield, N. J.

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Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRIVES, Machine
Cincinnati Lathe & Tool Co., Cincinnati
Dayton Rubber Mfg. Co., Dayton, O.
Drive-All Mfg. Co., Detroit
General Electric Co., Schenectady, N. Y.
Hardinge Brothers, Inc., Elmira, N. Y.
Reed-Prentice Co., Worcester, Mass.
Reliance Elec. & Engrg. Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Sheldon Mach. Co., Chicago
Turner Machinery Co., Kansas City, Mo.

DRIVES, Variable-Speed (See **TRANSMISSIONS, Variable-Speed**)

DRIVES, "V"-Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

DRIVES, Worm
Adams Company, Dubuque, Iowa
Bilgram Gear & Mach. Wks., Philadelphia
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Earle Gear & Mach. Co., Philadelphia
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
Grant Gear Works, Boston
Michigan Tool Co., Detroit
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia

DRYING Machines (See **MACHINES, Washing and Drying**)

ELECTRICAL EQUIPMENT (see also, **MOTORS, Electric; CONTROLLERS, MOTOR; SWITCHES**
Adam Elec. Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
General Electric Co., Schenectady, N. Y.
Square D Co., Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

ELECTRODES, Welding
Air Reduction, N. Y. C.
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee
Haynes-Stellite Co., N. Y. C.
Lincoln Electric Co., Cleveland
McKay Co., Pittsburgh, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ENAMELING & GALVANIZING MACHINES, Centrifugal
Barrett Co., Leon J., Worcester, Mass.

ENAMELS (See **PAINTS, VARNISHES, etc.**)

ENGRAVING MACHINES
Gorton Machine Co., Geo., Racine, Wis.
Moore Mfg. Co., Wm., Chicago
Reed-Prentice Co., Worcester, Mass.

ETCHERS, Electric
Breuer Electric Mfg. Co., Chicago

EXTRACTORS, Centrifugal Oil (See **SEPARATORS, Centrifugal**)

EXTRACTORS, Screw
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland

FANS, Man-Cooler (See **BLOWERS**)

FEEDS, Die (See **FEEDS, Press**)

FEEDS, Hydraulic
American Engineering Co., Philadelphia
Ex-Cell-O Tool Corp., Detroit
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

FEEDS, Press
Federal Press Co., Elkhart, Ind.
Henry & Wright Mfg. Co., Hartford, Conn.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Producto Machine Co., Bridgeport, Conn.
Schrader's Sons, A., N. Y. C.
V. & O. Press Co., Hudson, N. Y.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

FILE BANDS
Do All Co., Inc., Des Plaines, Ill.

FILES & RASPS
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins & Co., E. C., Indianapolis
Disston & Sons, Inc., Henry, Philadelphia
Nicholson File Co., Providence, R. I.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Inc., Binghamton, N. Y.
Strand & Co., N. A., Chicago

FILES, Rotary
Disston & Sons, Inc., Henry, Philadelphia
Hamilton Tool Co., Hamilton, O.
Strand & Co., N. A., Chicago

FILING MACHINES, Die
Ames Co., B. C., Waltham, Mass.
Continental Machines Inc., Milwaukee
Do All Co., Inc., Des Plaines, Ill.
Illinois Tool Co., Chicago
Oliver Instrument Co., Adrian, Mich.

FILTERS, Air
Cleveland Pneu. Tool Co., Cleveland
Curtis Pneu. Machy. Co., St. Louis
Norton Company, Worcester, Mass.

FINGERS, Feed
Eastern Machine Screw Corp., New Haven, Conn.

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Rivett Lathe & Grinder, Inc., Boston

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Weatherhead Co., Cleveland

FITTINGS, Wire-Rope
American Chain & Cable Co., Bridgeport, Conn.
American Steel & Wire Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Roebling's Sons Co., John A., Trenton, N. J.

FIXTURES, Indexing
Brown & Sharpe Mfg. Co., Providence, R. I.
Hartford Special Machinery Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati
Zagar Tool Inc., Cleveland

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Air Reduction, N. Y. C.
Oster Mfg. Co., Cleveland

FLEXIBLE SHAFT EQUIPMENT
Foredom Electric Co., N. Y. C.
Haskins Mfg. Co., R. G., Chicago
Strand Mfg. Co., N. A., Chicago

FLUX, Liquid & Paste
Air Reduction, N. Y. C.
Atkins & Co., E. C., Indianapolis
Eutetic Welding Alloys, Inc., N. Y. C.
Lincoln Electric Co., Cleveland

FORGES
Buffalo Forge Co., Buffalo, N. Y.

FORGING MACHINES (See also PRESSES, Forging)
Ajax Mfg. Co., Euclid, Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Hill Acme Co., Cleveland

FORGINGS (See Contract Work)

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Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Wks., Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
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Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

FURNACES, Electric
Electric Furnace Co., Salem, O.
General Electric Co., Schenectady, N. Y.
Lindberg Engineering Co., Chicago
Surface Combustion Corp., Toledo, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

FURNACES, Gas
American Gas Furn. Co., Elizabeth, N. J.
Chicago Flexible Shaft Co., Chicago
Despatch Oven Co., Minneapolis
Electric Furnace Co., Salem, Ohio
Hones, Inc., Chas. A. Baldwin, N. Y.
Lindberg Engineering Co., Chicago
Stark Tool Co., Waltham, Mass.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

FURNACES, Oil
Chicago Flexible Shaft Co., Chicago
Despatch Oven Co., Minneapolis
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo

FURNITURE, Shop
Black & Decker Mfg. Co., Towson, Md. (Drill Stands)
Hamilton Tool Co., Hamilton, O.
New Britain-Gridley Machine Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

GAGES, Amplifying
Federal Products Corp., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.

GAGES, Caliper
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

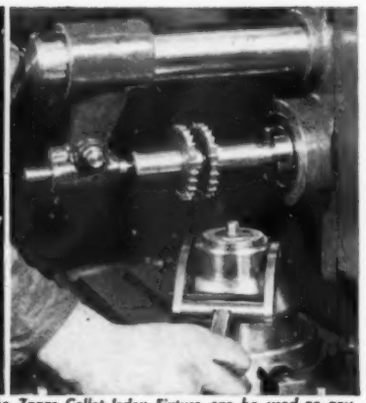
GAGES, Comparator
Ames Co., B. C. Waltham, Mass.
Federal Products Corp., Providence, R. I.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Continental Machines, Inc., Minneapolis
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

GAGES, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Randall & Stickney, Waltham, Mass.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Drill-Center
Brown & Sharpe Mfg. Co., Providence, R. I.

The ZAGAR COLLET INDEX FIXTURE Speeds up Holding and Indexing



The Zagar Collet Index Fixture can be used on any standard milling machine to mill slots, hexes, keyways, punches, taps, and to perform many other operations.

FOR MILLING, DRILLING, TAPPING, GRINDING, SLOTTING

The Zagar Collet Index Fixture can be adapted to practically any type of collet. It makes hexes, squares, slots, keyways, and holes. Two types; for holding and indexing or for holding only, each in 1" and 2" capacities. One handle opens, closes, and indexes. Any division from 2 to 25. No chip trouble, since the oil comes up through the collet to lubricate and clean out. Easy to set up; extremely simple in design.

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CAPACITIES—⅛ TO 3 H.P.
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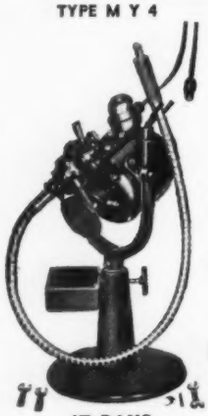

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Range	3″
Diameter of case	1 15/16″
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Depth of case	⅞″
Length over all	3½″
Lug or Bracket—Offset, on center if desired	Hole 3/16″
Back held in position by	4 large screws
Center of spindle to center of hole in lug	.15/16″
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Model C-10

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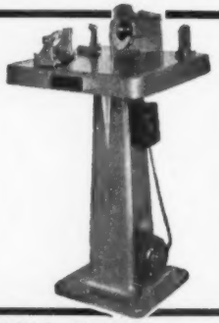

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Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

GAGES, Height
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Lufkin Rule Co., Saginaw, Mich.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

GAGES, Plug & Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Carboloy Co., Detroit
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Turner Gage Grinding Co., Ferndale, Mich.
Vard, Inc., Pasadena, Calif.

GAGES, Pressure
Baldwin-Southwark Corp., Philadelphia
Brown Instrument Co., Philadelphia

GAGES, Profile
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Snap (See GAGES, Plug & Ring)

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES, Thickness
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney Co., Waltham, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T. Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Wire
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Disston & Sons, Inc., Henry, Philadelphia
Federal Products Corp., Providence, R. I.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.

GALVANIZING MACHINES (See ENAMELING & GALVANIZING MACHINES)

GASES, Compressed
Air Reduction, N. Y. C.

GEAR-CUTTING MACHINES
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Colonial Broach Co., Detroit
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
General Mach. Corp., Hamilton, O.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Newark Gear Cutting Mach. Co., Newark
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Waltham Mach. Wks., Waltham, Mass.

GEAR-TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.

GEARS, Cast
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Fairfield Mfg. Co., Lafayette, Ind.
Farrel-Birmingham Co., Ansonia, Conn.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works, Inc., Boston
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield Mass.
Philadelphia Gear Works, Philadelphia

GEARS, Cut
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Baush Mach. Tool Co., Springfield, Mass.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Braun Gear Corp., Brooklyn, N. Y.
Carlyle Johnson Machine Co., Manchester, Conn.
Cincinnati Gear Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Earle Gear & Machine Co., Philadelphia
Fairfield Mfg. Co., Lafayette, Ind.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties Inc., Chicago
Gleason Works, Rochester, N. Y.
Grant Gear Works, Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Michigan Tool Co., Detroit
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Stahl Gear & Machine Co., Cleveland

GEARS, Master
Earle Gear & Mach. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GEARS, Non-Metallic
Adams Co., Dubuque, Iowa
Bakelite Corp., N. Y. C.
Bilgram Gear & Mach. Wks., Philadelphia
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.

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James Co., D. O., Chicago
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Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Stahl Gear & Machine Co., Cleveland
Taylor Machine Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

GOGGLES, Face Shields & Sweat Bands
American Optical Co., Southbridge, Mass.

GRAINS, Abrasive
Bay State Abrasive Prod. Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Sterling Grinding Wheel Div., Tiffin, O.

GRINDERS, Abrasive-Belt
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Mattison Machine Works, Rockford, Ill.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

GRINDERS, Bench & Pedestal
Atlas Press Co., Kalamazoo, Mich.
Black & Decker Mfg. Co., Towson, Md.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Machinery & Engrg. Co., Chicago
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Hardinge Brothers, Inc., Elmira, N. Y.
Hobart Brothers, Troy, Ohio
Norton Co., Worcester, Mass.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Queen City Machine Tool Co., Cincinnati
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker Co., O. S., Worcester, Mass.
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

GRINDERS, Cam
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDERS, Carbide Tool
Blount Co., J. G., Everett, Mass.
Ex-Cell-O Corp., Detroit
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

GRINDERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Heald Machine Co., Worcester, Mass.
Metal Carbides Corp., Youngstown, O.

GRINDERS, Chucking
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mach. Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDERS, Contour
Baker Bros., Inc., Toledo, Ohio
Blanchard Machine Co., Cambridge, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Cutter & Tool
Abrasive Mach. Tool Co., E. Providence, R. I.
Barber-Colman Co., Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Boggis & Co., H. P., Cleveland
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Carboloy Co., Inc., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
General Machinery Corp., Boston
Geometric Tool Co., New Haven, Conn.
Gorton Machine Co., Geo., Racine, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Kearney & Trecker Co., Milwaukee
Landis Machine Co., Waynesboro, Pa.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
National Acme Co., Cleveland
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sellers & Co., Inc., Wm., Philadelphia
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Cylindrical
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Inc., Cincinnati
Dumore Co., Racine, Wis.
Farrel-Birmingham Co., Ansonia, Conn.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Disk
Delta Mfg. Co., Milwaukee
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Queen City Mach. Tool Co., Cincinnati
Walls Sales Corp., N. Y. C.

GRINDERS, Drill & Tap
Blake Co., Edward, Newton Center, Mass.
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Wm., Philadelphia
Union Twist Drill Co., Athol, Mass.

GRINDERS, Face or Ring Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Blanchard Machine Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Bickford Tool Co., Oakley, Cincinnati
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.

GRINDERS, Gear
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gear Grinding Machine Co., Detroit
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GRINDERS, Internal
Arter Grinding Mach. Co., Worcester, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Rivett Lathe & Grinder, Inc., Boston
Sav-Way Tool & Mach. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Jig
Moore Spec. Tool Co., Bridgeport, Conn.

GRINDERS, Knife & Shear-Blade
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atkins & Co., E. C., Indianapolis
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hill Acme Co., Cleveland
Mattison Machine Works, Rockford, Ill.
Rogers & Co., Samuel C., Buffalo, N. Y.

GRINDERS, Lathe-Attachment (See **ATTACHMENTS, Lathe**)

GRINDERS, Portable Electric (See also **TOOLS, Portable Electric**)
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg. Co., Chicago
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rotor Tool Co., Cleveland

GRINDERS, Spline
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS, Surface
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atlantic Machinery Co., N. Y. C.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Machine Co., Beloit, Wis.
Hammond Machy. Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Hill Acme Co., Cleveland
Landis Tool Co., Waynesboro, Pa.
Leach Machinery Co., H., Providence, R. I.
Mattison Machine Works, Rockford, Ill.
Murchey Machine & Tool Co., Detroit
Norton Co., Worcester, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

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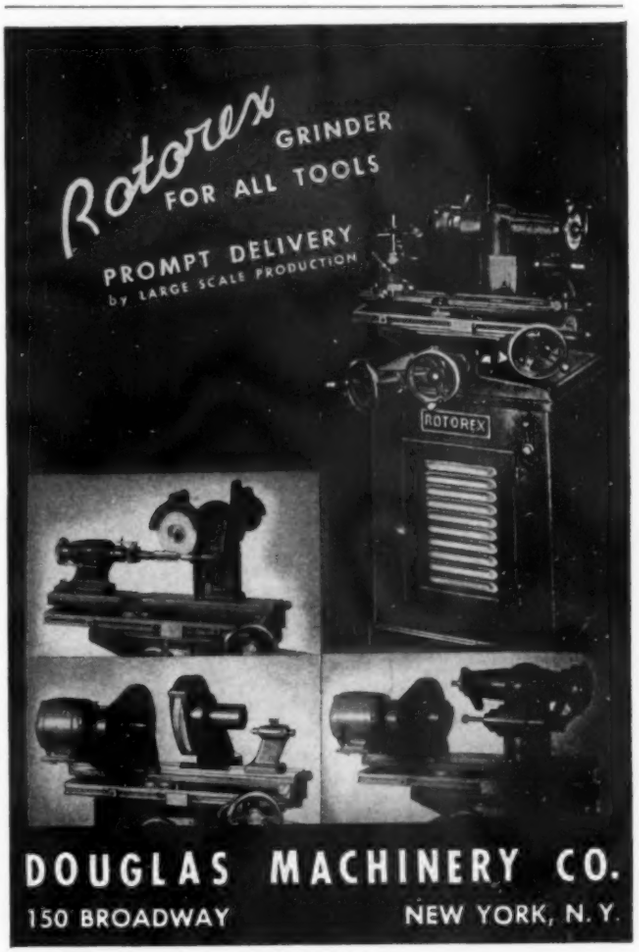

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Here's the grinder you can keep busy all the time. Its heavy construction and rigidity make it an ideal production machine; its wide variety of attachments enable it to handle all kinds of tool sharpening and tool room grinding.

The neat, compact motor-in-head design is dust-proof, and can be depended on for vibrationless performance. Base and standard are a one-piece casting upon which the head swivels. An extra broad knee splined to standard prevents any loss of horizontal adjustment of work while feeding. An important convenience feature is offered in the sleeve of the elevating hand wheel which is provided with graduations reading in thousandths of an inch. Table is graduated at both ends making it easy to set for taper work.

Other features are offered which are well worth investigating.

SPECIFICATIONS

Swing over table—6¼"
Dist. between centers—21"
Length of Table Travel—15"
Cross feed—6"
Vertical feed—7"
Capacity Cutters on Centers—6¼" dia.
Capacity Cutters on Holder—14" dia.
Chuck Capacity—2¼"

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Also manufacturers of Drilling Machines and Hand and Automatic Polishing and Grinding Machines

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QUALITY ACCURACY DURABILITY ECONOMY

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EAST PROVIDENCE, R. I.

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Landis Machine Co., Waynesboro, Pa.

GRINDERS, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Thompson Grinder Co., Springfield, O.

GRINDING, Centerless (See **CONTRACT WORK**)

GROOVERS, Oil
Hanson-Whitney Mach. Co., Hartford, Conn.
National Machine Tool Co., Cincinnati

GUARDS & SAFETY APPLIANCES, Machinery
Littleford Bros., Cincinnati
Schrader's Son, A., Brooklyn, N. Y.

HAMMERS, Drop
Farrel-Birmingham Co., Ansonia, Conn.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

HAMMERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
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General Machinery Corp., Hamilton, O.
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HAMMERS, Softfaced
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Johnson Tool Co., Inc., E. Providence, R. I.

HANDLES, Crank & Machine
Machine Products Corp., Detroit
Williams & Co., J. H., Buffalo, N. Y.

HANDLES, File
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Nicholson File Co., Providence, R. I.
Parker-Kalon Corp., N. Y. C.

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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
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Wright Mfg. Div. of Am. Chain Cable Co., York, Pa.

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Harnischfeger Corp., Milwaukee
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Watson-Stillman Co., Roselle, N. J.

INDEXING FIXTURES (See FIXTURES, Indexing)

INDICATORS, Dial (See GAGES, Dial)

INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.
Brown Instrument Co., Philadelphia
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

INDICATORS, Temperature
Brown Instrument Co., Philadelphia

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Shore Inst. & Mfg. Co., Jamaica, N. Y.
Wilson Mechanical Inst. Co., N. Y. C.

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Vard, Inc., Pasadena, Calif.

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Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

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Reed-Prentice Corp., Worcester, Mass.

JIGS & FIXTURES (See CONTRACT WORK)

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Niagara Mach. & Tool Wks., Buffalo, N. Y.

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Ultra-Lap Mach. Co., Detroit

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Norton Co., Worcester, Mass.
Sellers & Co., Inc., Wm., Philadelphia
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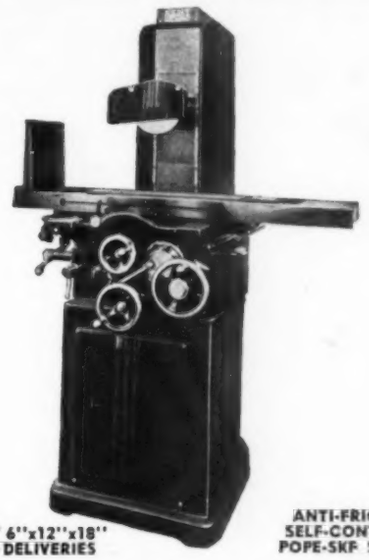

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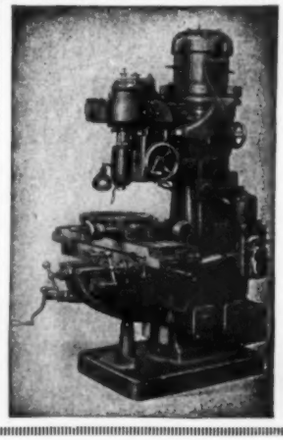

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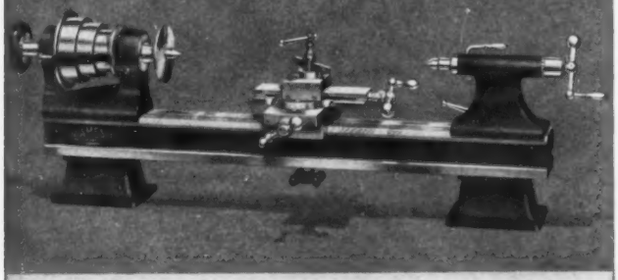

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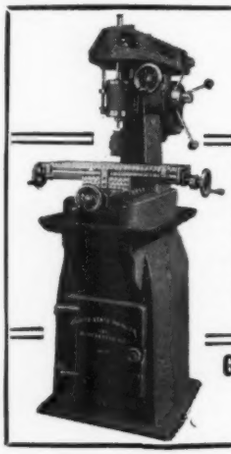

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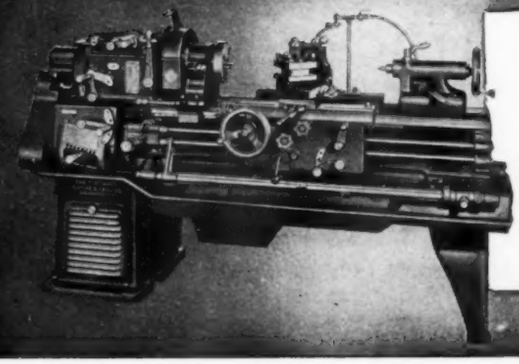

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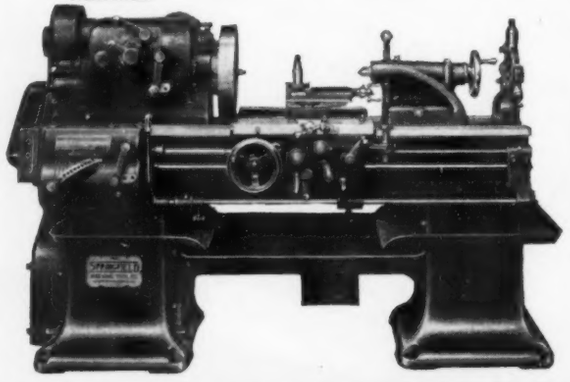

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PRESSES, Foot
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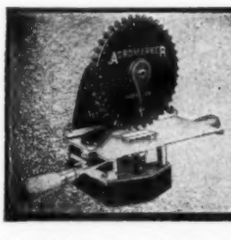

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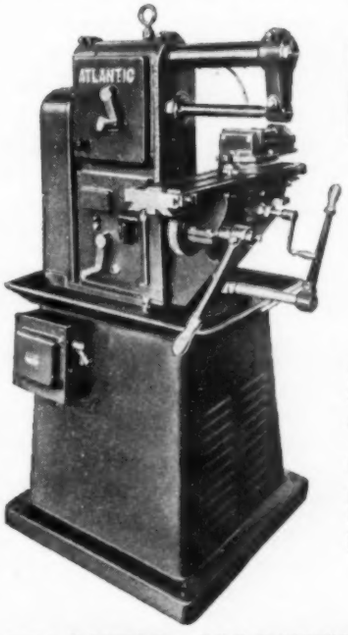

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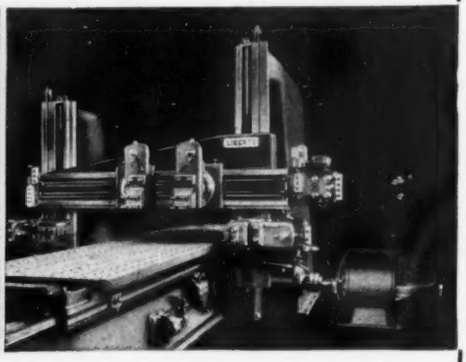

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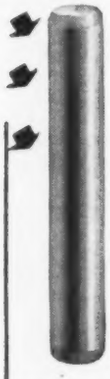

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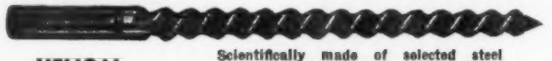

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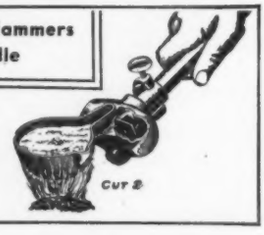

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PURIFIERS, Oil & Coolant
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

PYROMETERS, Indicating & Recording
Brown Instrument Co., Philadelphia

QUENCHERS
American Gas Furn. Co., Elizabeth, N. J.
Electric Furnace Co., Salem, O.
Farrel-Birmingham Co., Buffalo, N. Y.
Gleason Works, Rochester, N. Y.

RACKS, Gear (See **GEARS, Cut**)

RASPS (See **FILES & RASPS**)

RATCHETS (See **GEARS, Cut**)

REAMERS, Adjustable
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.

REAMERS, Pipe
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Twist Drill Co., Cleveland
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.

WHERE-TO-BUY DIRECTORY

National Twist Drill & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Standard Tool Co., Cleveland
Torrington Co., Torrington, Conn.

REAMERS, Shell
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Schultz & Anderson Co., Newark, N. J.
Union Twist Drill Co., Athol, Mass.

REAMERS, Solid
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., N. Y. C.
Holman Reamer Co., Manchester, Conn.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.

REAMING MACHINES
Blanchard Machine Co., Cambridge, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Cleveland Pneu. Tool Co., Cleveland
Rotor Tool Co., Cleveland
Van Norman Machine Tool Co., Springfield, Mass.

RECORDERS, Speed (See **INDICATORS, Speed**)

RECORDERS, Temperature & Pressure
Brown Instrument Co., Philadelphia

REDUCERS, Motorized Speed
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Dumore Co., Racine, Wis.
Earle Gear & Machine Co., Philadelphia
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston, Mass.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

REDUCERS, Speed
Adams Co., Dubuque, Iowa
Davis & Thompson Co., Milwaukee
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
General Machinery Corp., Hamilton, O.
Grant Gear Works, Inc., Boston
James Co., D. O., Chicago
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Stahl Gear & Machine Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

REELS, Strip-Stock & Wire
Nilson Mach. Co., A. H., Bridgeport, Conn.
Yoder Co., Cleveland

REFRACTORIES
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Strong, Carlisle & Hammond Co., Cleveland

REGULATORS, Speed
Vickers, Inc., Detroit

REGULATORS, Temperature
American Gas Furn. Co., Elizabeth, N. J.
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia

RIFLING MACHINES, Gun
American Broach & Machine Co., Ann Arbor, Mich.
Illinois Tool Works, Chicago
LeBlond Mach. Tool Co., R. K., Cincinnati
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

RIVETERS, Electric Power
Buffalo Forge Co., Buffalo, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Linley Bros. Co., Bridgeport, Conn.
Tomkins-Johnson Co., Jackson, Mich.

RIVETERS, Pneumatic & Hydraulic
Baldwin-Southwark Corp., Philadelphia
Cleveland Pneu. Tool Co., Cleveland
Elmes Engrg. Wks., Chas. P., Chicago
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.

RIVETS
Aluminum Co. of America, Pittsburgh
American Steel & Wire Co., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.

ROLLS, Bending
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N.Y.
General Machinery Corp., Hamilton, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago

ROLLS, Forging
Ajax Mfg. Co., Cleveland
Bethlehem Steel Co., Bethlehem, Pa.

ROPE, Wire
American Cable Div. of Am. Chain & Cable Co., N. Y. C.
Bethlehem Steel Co., Bethlehem, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago

ROUTERS
Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machy. Co., W. B., St. Louis
Onsrud Machine Works, Chicago
Reed-Prentice Corp., Worcester, Mass.

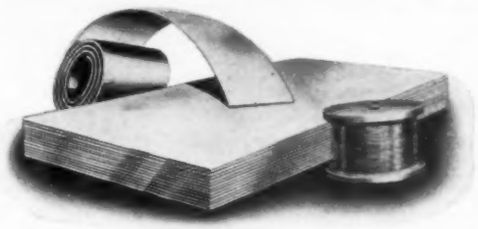
RULES, Machinists'
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

RUSTPROOFING & SLUSHING COMPOUNDS
Bakelite Corp., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products Co., N. Y. C.
Socony-Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Indiana, Chicago
Tidewater Oil Co., N. Y. C.

SAFETY EQUIPMENT
American Optical Co., Southbridge, Mass.
Littleford Bros., Cincinnati

SANDERS, Machine & Portable
Black & Decker Mfg. Co., Towson, Md.
Carborundum Co., Niagara Falls, N. Y.
Delta Mfg. Co., Milwaukee
Haskins Co., R. G., Chicago
Jefferson Machine Tool Co., Cincinnati
Mattison Machine Works, Rockford, Ill.
Mead Specialties Co., Chicago
Porter-Cable Mach. Co., Syracuse, N. Y.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland

WIRE • SHEETS



WIRE—in coils for spring manufacture. Flat wire, in coils or lengths. Tinned binding wire, for armature work. Binding wire (round), dead soft to any temper required. Straightened wire (round), in lengths.

SHEETS—in rolls. Slit sheet metal, tinned both sides. In various gauges and tempers covering a broad range of uses.

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TOUGH • STRONG • ELASTIC
RESISTANT TO CORROSION

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• Less Wear
WITH

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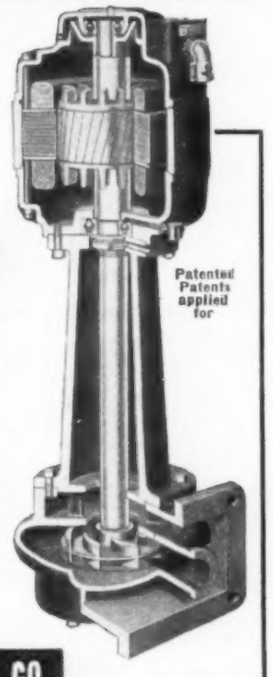

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The Gusher Pump is a masterpiece of simple design, and thoroughly efficient.

All packing nuts are eliminated—an advantage of vertical construction—therefore, no friction or binding. No metal-to-metal contact. No foot or relief valves—yet there is no leakage. Not harmed by chips and grit. No strainers necessary. Saves power. Speeds production.

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THE RUTHMAN MACHINERY CO.
1809 READING ROAD, CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

WHERE-TO-BUY DIRECTORY

Skilsaw, Inc., Chicago
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

SAW BLADES, Circular Metal-Cutting
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg., Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

SAW BLADES, Hack & Band (See **BLADES, Hack & Band-Saw**)

SAWS, Band, Metal-Cutting (Machines)
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Capewell Mfg. Co., Hartford, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Kalamazoo Tank & Silo Co. (Machine Tool Div.), Kalamazoo, Mich.
Peerless Machine Co., Racine, Wis.
Racine Tool & Machine Co., Racine, Wis.
Reed-Prentice Corp., Worcester, Mass.
Ryerson & Son, Inc., Jos. T., Chicago
Starrett Co., L. S., Athol, Mass.
Walker-Turner Co., Plainfield, N. J.

SAWS, Circular, Metal-Cutting (Machines)
Consolidated Mach. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Earle Gear Machine Co., Philadelphia
Motch & Merryweather Co., Cleveland
Porter-McLeod Machine Tool Co., Hatfield, Mass.

SAWS, Circular, Wood-Cutting (Machine)
Atkins & Co., E. C., Indianapolis
Curtis Pneumatic Machy. Co., St. Louis
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Mattison Machine Works, Rockford, Ill.
Walker-Turner Co., Inc., Plainfield, N. J.

SAWS, Friction
Ryerson & Son, Inc., Jos. T., Chicago

SAWS, Hack (See **TOOLS, Hand**)

SAWS, Hole
Armstrong-Blum Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Black & Decker Mfg. Co., Towson, Md.
Earle Gear & Machine Co., Philadelphia
Schrader's Sons, A., N. Y. C.
Skilsaw, Inc., Chicago

SAWS, Portable (See **TOOLS, Portable**)

SAWS, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Covel Mfg. Co., Benton Harbor, Mich.
L-W Chuck Co., Toledo, Ohio
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Racine Tool & Mach Co., Racine, Wis.
Ryerson & Son, Inc., Jos. T., Chicago

SCRAPERS, Hand (See **TOOLS, Hand**)

SCRAPERS, Power
Black & Decker Mfg. Co., Towson, Md.

SCREWDRIVERS, Flexible-Shaft (See **TOOLS, Flexible-Shaft**)

SCREWDRIVERS, Hand (See **TOOLS, Hand**)

SCREWDRIVERS, Portable Electric & Pneumatic (See **TOOLS, Portable**)

SCREWDRIVING & NUT-SETTING MACHINES
Bodine Corp., Bridgeport, Conn.
Haskins Co., R. G., Chicago
Producto Machine Co., Bridgeport, Conn.
Schauer Machine Co., Cincinnati
Strand & Co., N. A., Chicago

SCREW-MACHINES, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Scherr Co., Inc., George, N. Y. C.
Warner & Swasey Co., Cleveland

SCREW-MACHINES, Plain & Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Warner & Swasey Co., Cleveland

SCREW PLATES (See **DIES, Screw-Cutting, Adjustable**)

SCREWS, Cap and Set
Allen Mfg. Co., Hartford, Conn.
Baumbach Mfg. Co., E. A., Chicago
Danly Machine Specialties, Inc., Chicago
Eastern Machine Screw Corp., New Haven, Conn.
National Acme Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Machine
Allen Mfg. Co., Hartford, Conn.
Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
Republic Steel Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Recessed Head
American Screw Co., Providence, R. I.
Central Screw Co., Chicago
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Mfrs. Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago
Southington Hardware Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping
Parker-Kalon Corp., N. Y. C.

SCREWS, Thumb & Wing
Parker-Kalon Corp., N. Y. C.

SCRIBERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

SEPARATORS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
National Acme Co., Cleveland

SETS, Rivet
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland

SETTERS, Nut (See **TOOLS, Portable**)

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Earle Gear & Mach. Co., Philadelphia
Jones & Laughlin Steel Corp., Pittsburgh
National Tube Co., Pittsburgh
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Union Drawn Steel Co., Massillon, O.
Wyckoff Drawn Steel Co., Pittsburgh

SHAFTS, Flexible
Dumore Co., Racine, Wis.
Errington Mech. Lab., Stapleton, N. Y.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.

SHAPERS
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atkins & Co., E. C., Indianapolis
Atlas Press Co., Kalamazoo, Mich.
Automotive Maintenance Machinery Co., N. Chicago, Ill.
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Hanson-Whitney Mach. Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Ohio Machine Tool Co., Kenton, O.
Pratt & Whitney Div., Niles-Bement-Bond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Smith & Mills Co., Cincinnati

SHARPENERS, Saw
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Mead Specialties Co., Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Weldon Tool Co., Cleveland

SHAVING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Michigan Tool Co., Detroit

SHEARS, Hand
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Minneapolis

SHEARS, Rotary
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEARS, Squaring
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Kent-Owens Machine Co., Toledo, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEAVES, "V" Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Earle Gear & Machine Co., Philadelphia
Gates Rubber Co., Denver, Colo.
Hill Acme Co., Cleveland

SHEET-METAL WORKING MACHINERY (See **BRAKES, Bending Press; DIES, Sheet-Metal; Forming Machines; NIBBLERS; PRESSES; REELS. Stripstock; RIVETERS; ROLLS, Bending; SHEARS; STITCHERS, Metal**)

SHELL-MAKING Machinery
Bullard Co., Bridgeport, Conn.
Colman & Sons, Frederick, Detroit
Hepburn American Co., Greenwich, Conn.
Morey Machinery Co., Inc., N. Y. C.

SHIPPING SERVICE
Railway Express, All Principal Cities

SKIDS (See **TRUCKS, Hand**)

SLEEVES & SOCKETS, Drill
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

SLOTTERS
Baker Bros., Inc., Toledo, O.
Consolidated Machine Tool Corp., Rochester, N. Y.
Douglas Machinery Co., Inc., N. Y. C.
General Machinery Corp., Hamilton, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

SOCKETS, Drill (See **SLEEVES & SOCKETS, Drill**)

SOLVENTS, Oil & Grease
Detroit Rex Products Co., Detroit
Oakite Products, Inc., N. Y. C.

SPINDLES, Machine
Bryant Chucking Grinder Co., Springfield, Vt.
Dumore Co., Racine, Wis.
Ex-Cell-O Corp., Detroit
Heald Machine Co., Worcester, Mass.
Monarch Machine Tool Co., Sidney, O.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago

SPRINGS, Die
Allen Mfg. Co., Hartford, Conn.
Danly Machine Specialties, Chicago

SPROCKETS (See **GEARS, Cut**)

SQUARES, Precision (See **BLOCKS, Precision Gage**)

STAMPINGS, Metal
Acromark Corp., Elizabeth, N. J.
American Brass Co., Waterbury, Conn.
Continental Machines, Inc., Minneapolis
Revere Copper & Brass Inc., N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.
Sundstrand Mach. Tool Co., Rockford, Ill.

STAMPS & HOLDERS, Steel, Safety
Acromark Corp., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Moore Mfg. Co., Wm., Chicago
Noble & Westbrook Mfg. Co., East Hartford, Conn.

STAMPS, Steel (See **DIES, Marking & Embossing**)

STARTERS, Motor (See **CONTROLLERS, Motor**)

STEEL, Die
Allegheny Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube, Div., Canton, O.
Vanadium Alloys Steel Co., Pittsburgh

STEEL-MILL PRODUCTS
Allegheny-Ludlum Steel Corp., Pittsburgh (Steel and stainless steel sheets, plates, tubes, wire and strip)

WHERE-TO-BUY DIRECTORY

American Steel & Wire Co., Cleveland (Cold-finished bars, wire and wire products)
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., Cleveland (Tubing)
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O. (Cold-finished)
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Stainless (See preceding classification)

STEEL, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
United States Steel Corp., Pittsburgh
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy Co., Inc., Cambridge, Mass.

STERILIZERS, Oil
Barrett Co., Leon J., Worcester, Mass.

STOCKS, Dies & Cutters, Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Tool Co., Cleveland

STONES, Sharpening
Bay State Abrasive Products Co., Westboro, Mass.
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

STRAIGHTEDGES (See DIE-MAKERS' SUPPLIES)

STRAIGHTENERS, Wire
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

STRAIGHTENING & SIZING MACHINES
Taylor Wilson Mfg. Co., McKees Rocks, Pa.

SUB-PRESSES & DIES (See Dies, Subpress)

SUPERFINISHING EQUIPMENT
Ultra-Lap Mach. Co., Detroit

SURFACE-BROACHING MACHINES (See BROACHING MACHINES)

SURFACE PLATES (See PLATES, Surface)

SWAGING MACHINES
Etna Machine Co., Toledo
Hardinge Brothers, Inc., Elmira, N. Y.
Torrington Co., Torrington, Conn.

SWITCHES, Electric
Adam Electric Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
L-W Chuck Co., Toledo, O.
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SWITCHES, Limit
Adam Electric Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
National Acme Co., Cleveland
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SYSTEMS, Production & Tool Control
McCaskey Register Co., Alliance, O.

TABLES, Elevating Portable
Hamilton Tool Co., Hamilton, O.

TACHOMETERS (See INDICATORS, Speed)

TANKS & CYLINDERS, Air
Anker Holth Mfg. Co. (Airgrip Chuck Div.) Port Huron, Mich.
Clearing Machine Corp., Chicago
Curtis Pneu. Machinery Co., St. Louis
National Tube Co., Pittsburgh
Tomkins-Johnson Co., Jackson, Mich.

TAPER PINS (See PINS, Dowel & Taper)

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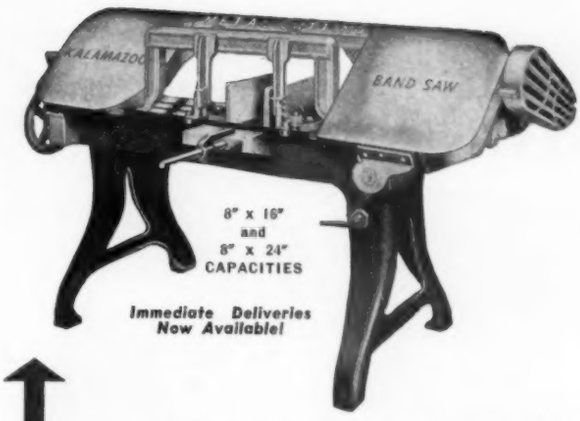
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

TAPPERS, Single & Multi-Spindle
Armstrong-Blum Mfg. Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bodine Corp., Bridgeport, Conn.
Bradford Mach. Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati-Gilbert Machine Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Ettco Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Haskins Co., R. G. Chicago
Hill Acme Co., Cleveland
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Auto. Tool Co., Richmond, Ind.
Rickert-Shafer Co., Erie, Pa.
Snyder Tool & Engrg. Co., Detroit

TAPS, Adjustable (See DIES, Adjustable)

TAPS, Hand & Machine, Solid
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit



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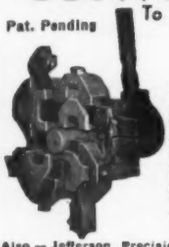

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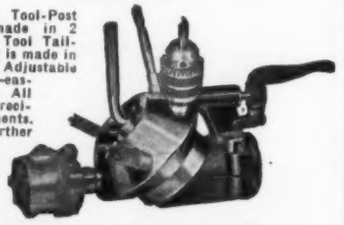

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Murchey Machine & Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Wood & Spencer Co., Cleveland

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Hartford Special Machinery Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.

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Ex-Cell-O Corp., Detroit
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Lees-Bradner Co., Cleveland
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Wks., Waltham, Mass.
Warner & Swasey Co., Cleveland

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Brown & Sharpe Mfg. Co., Providence, R. I.
Hill Acme Co., Cleveland
V. & O. Press Co., Hudson, N. Y.

THERMOMETERS, Dial
Brown Instrument Co., Philadelphia
Strong, Carlisle & Hammond Co., Cleveland

TOOL HOLDERS (See **HOLDERS, Tool**)

TOOL POSTS, Lathe
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Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Williams & Co., J. H., Buffalo, N. Y.

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Armstrong Bros. Tool Co., Chicago
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Heald Machine Co., Worcester, Mass.
Illinois Tool Works, Chicago
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Burring
Nobur Mfg. Co., Los Angeles

TOOLS and PARTS, Cemented-Carbide
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Carboloy Co., Inc., Detroit
Crafts Co. Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston and Sons, Inc., Henry, Tacony, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Grayson Mfg. Co., Monrovia, Cal.
Illinois Tool Works, Chicago
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Sheffield Corp., Dayton, O.
Tungsten Elec. Corp., Union City, N. J.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., Chicago
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Diamond-Tipped
Crafts Co., Arthur A., Boston
Desmond-Stephen Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Gorton Machine Co., Geo., Racine, Wis.
Kent-Owens Machine Co., Toledo, O.
Koebel Diamond Tool Co., Detroit
Norton Company, Worcester, Mass.
Smit & Son, J. K., N. Y. C.

TOOLS, Flexible-Shaft
Dumore Co., Racine, Wis.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Walker-Turner, Inc., Plainfield, N. J.

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Allen Mfg. Co., Hartford, Conn.
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Atkins & Co., F. C., Indianapolis
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Capewell Mfg. Co., Hartford, Conn.
Carboloy Co., Detroit
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Punch & Shear Works Co., Cleveland
Cleveland Twist Drill Co., Cleveland
Crafts Co., Arthur A. Boston
Dearborn Gage Co., Dearborn, Mich.
Disston & Sons, Inc., Henry, Philadelphia
Elastic Stop Nut Corp., Union, N. J.
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Greene, Tweed & Co., N. Y. C.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hamilton Tool Co., Hamilton, O.
Lufkin Rule Co., Saginaw, Mich.
National Twist Drill & Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
North Bros. Mfg. Co., Philadelphia
Numberall Stamp & Tool Co., Huguenot Park, N. Y.
Plomb Tool Co., Los Angeles
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Racine Tool & Mach. Co., Racine, Wis.
Scully-Jones & Co., Chicago
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Thompson & Son Co., Henry G., New Haven, Conn.
Union Twist Drill Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.
Williams & Co., J. H., Buffalo, N. Y.

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Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Blake Co., Edward, Newton Centre, Mass.
Bullard Co., Bridgeport, Conn.

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Cleveland Twist Drill Co., Cleveland
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Empire Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Illinois Tool Works, Chicago
Jefferson Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Nobur Mfg. Co., Los Angeles
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Starrett Co., L. S., Athol, Mass.
Sturdimatic Tool Co., Detroit
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Portable Electric
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Chicago Wheel & Mfg. Co., Chicago
Delta Mfg. Co., Milwaukee
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Foredom Electric Co., N. Y. C.
Hisey-Wolf Machine Co., Cincinnati
Rotor Tool Co., Cleveland
Schauer Machine Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

TOOLS, Portable Pneumatic
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Onsrud Machine Works, Inc., Chicago
Rotor Tool Co., Cleveland
Sheldon Machine Co., Chicago

TOOLS, Stellite
Haynes Stellite Co., N. Y. C.

TORCHES, Gas-Cutting & Welding
Air Reduction, N. Y. C.

TRANSMISSIONS, Hydraulic
American Engrg. Co., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Ex-Cell-O Corp., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

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Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Continental Machine, Inc., Minneapolis
Earle Gear & Machine Co., Philadelphia
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Reeves Pulley Co., Columbus, Ind.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

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Cullen-Friestedt Co., Chicago
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Standard Conveyor Co., No. St. Paul, Minn.
Wright Mfg. Div. Am. Chain & Cable Co., Inc., York, Pa.

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Standard Pressed Steel Co., Jenkintown, Pa.

TUBING, Steel
Bissett Steel Co., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube Co., Canton, Ohio

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Jefferson Machine Tool Co., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Warner & Swasey Co., Cleveland

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Kingsbury Mach. Tool Corp., Keene, N. H.

UPSETTERS (See Forging Machines)

USED MACHINERY (See Searchlight Section)

V BLOCKS (See Blocks, V)

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Ross Operating Valve Co., Detroit
Schrader's Son, A., Brooklyn, N. Y.
Tomkins-Johnson Co., Jackson, Mich.

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Barnes Co., W. F. & John, Rockford, Ill.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Elmes Engrg. Wks., Chas. F., Chicago
Nicholson & Co. W. H., Wilkes-Barre, Pa.
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Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.
Weatherhead Co., Cleveland

VERNIERS
Brown & Sharpe Mfg. Co., Providence, R. I.

VISES, Air-Operated
Ross Operating Valve Co., Detroit
Tomkins-Johnson Co., Jackson, Mich.

VISES, Machine
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago Wheel & Mfg. Co., Chicago
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Cincinnati Planer Co., Cincinnati
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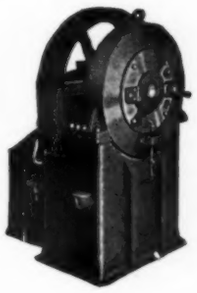

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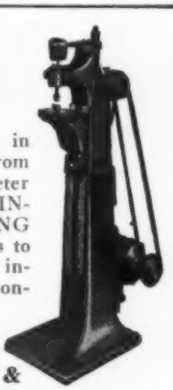

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Yost Mfg. Co., Meadville, Pa.

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Fenn Mfg. Co., Hartford, Conn.
Fray Machine Tool Co., Glendale, Calif.
Jefferson Mach. Tool Co., Cincinnati
New Britain-Gridley Machine Co., New Britain, Conn. (Stands)
North Bros. Mfg. Co., Philadelphia
Wiedemann Machine Co., Philadelphia

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Armstrong Bros. Tool Co., Chicago
Desmond-Stephan Mfg. Co., Urban, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

WASHERS, Lock
National Lock Washer Co., Newark, N. J.

WASHING & DRYING, Machines (See METAL-CLEANING EQUIPMENT)

WELDERS, Arc
Air Reduction, N. Y. C.
Allis-Chalmers Mfg. Co., Milwaukee
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Harnischfeger Corp., Milwaukee
Hobart Bros. Co., Troy, O.
Lincoln Electric Co., Cleveland
Westinghouse Elec. & Mfg. Co. E. Pittsburgh, Pa.

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WELDERS, Spot
Ohio Machine Tool Co., Kenton, O.
Progressive Welder Co., Detroit

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Mallory & Co., Inc., P. R., Indianapolis (Electrode Holders)

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Lincoln Electric Co., Cleveland

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General Electric Co., Schenectady, N. Y.

WELDING POSITIONERS
Cullen-Friestedt Co., Chicago

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American Steel & Wire Co., Cleveland
Atkins & Co., E. C., Indianapolis
Harnischfeger Corp., Milwaukee
Haynes Stellite Co., N. Y. C.
Hobart Bros. Co., Troy, O.
Lincoln Electric Co., Cleveland
McKay Co., Pittsburgh
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Revere Copper & Brass Corp., N. Y. C.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

WELDING TIMERS
Lincoln Electric Co., Cleveland

WELDING TIPS
Mallory & Co., Inc., P. R., Indianapolis

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Bay State Abrasive Products Co., Westboro, Mass.
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Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
Cincinnati Milling Mach. Co., Cincinnati
deSanno & Son, Inc., A. P., Phoenixville, Pa.
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Midwest Abrasive Co., Detroit
Norton Co., Worcester, Mass.
Porter-Cable Mach. Co., Syracuse, N. Y.
Roberts Rubber Co., Weldon, Newark, N. J.
Sterling Grinding Wheel Co., Tiffin, O.
Vitrified Wheel Co., Westfield, Mass.

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Burcott Mills, Chicago

WIRE, Spring
American Brass Co., Waterbury, Conn.
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Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh
Page Steel & Wire Div. Amer. Chain & Cable Co., Inc., Monessen, Pa.
Revere Copper & Brass Inc., N. Y. C.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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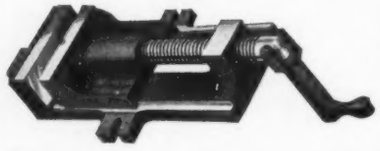

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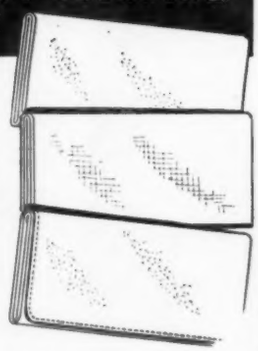

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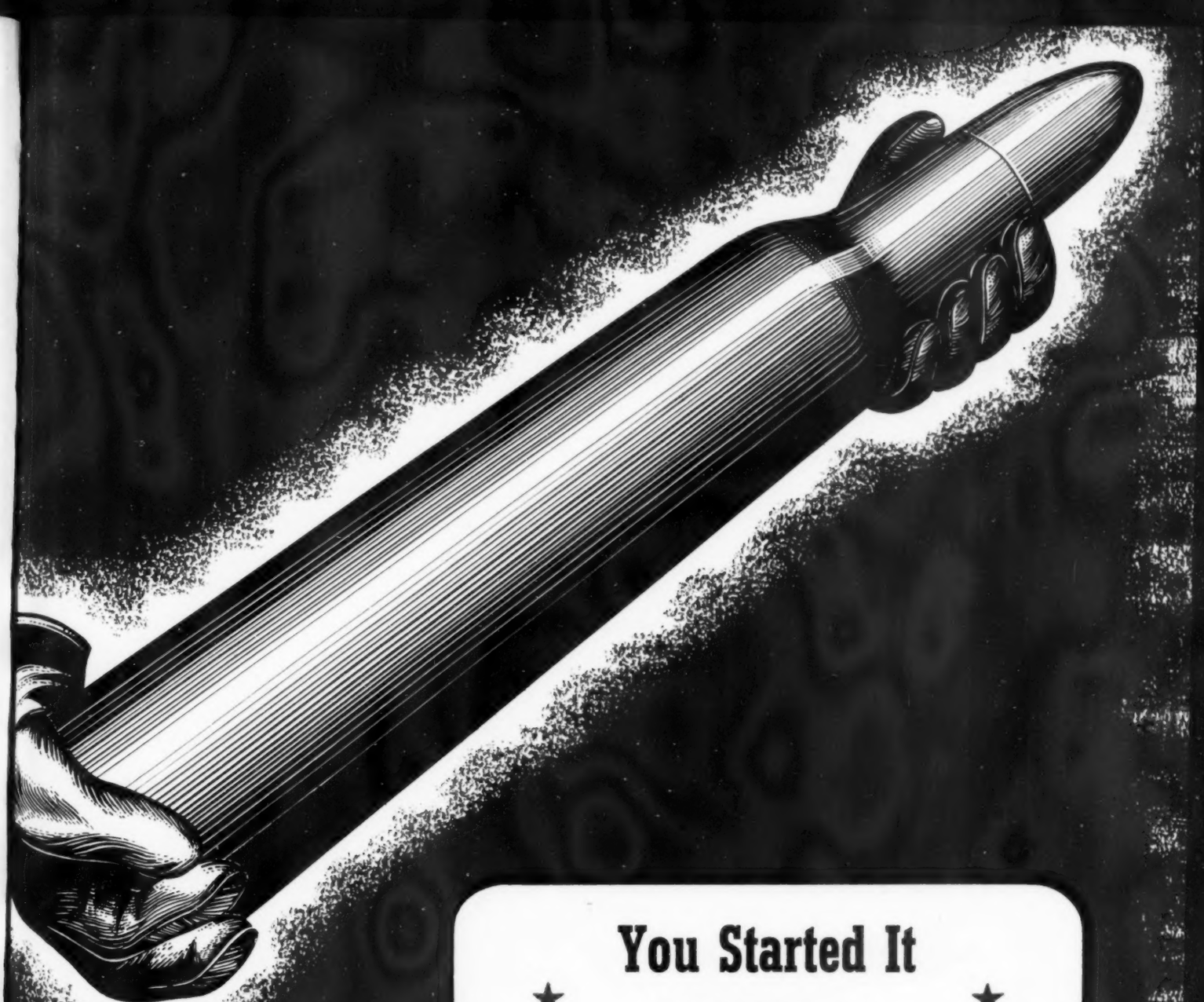

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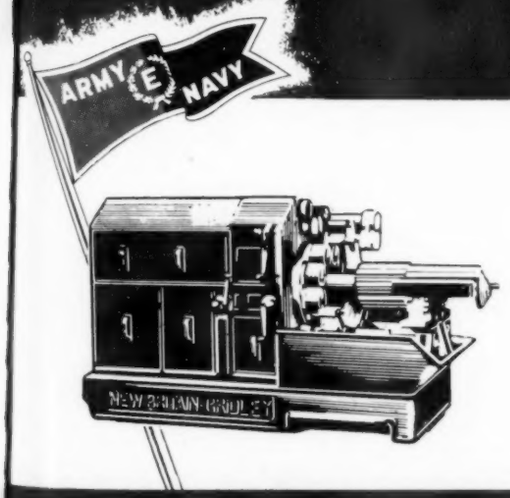

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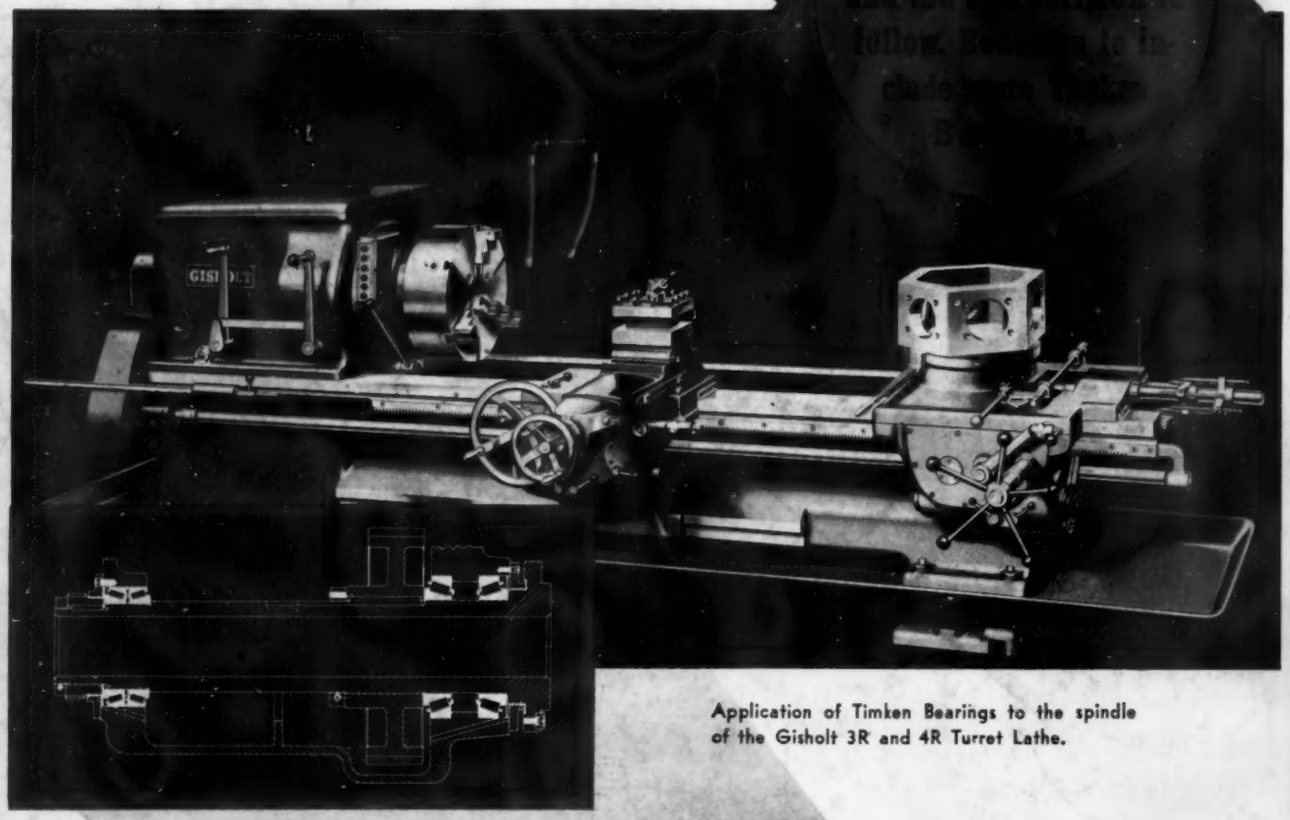

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